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LEGAL STATUS OF THE VETERINARY SURGEON.

THAT the curious anomaly of veterinary appointments being filled by unqualified persons still exists even in State service is forcibly brought home to us by the voluminous correspondence which is at the present time taking place in the newspaper press of the Irish Free State on the subject of the new Veterinary Bill which is now before the *Dail*.

The controversial tones of the discussion reveal an idea of the extent to which the veterinary surgeon must lose financially at the present time through the work done by the prescribing chemist, the cow leech, and the horse doctor; but if the Bill does eventually become law it will put the profession in Ireland on a better and more independent footing than it is even in England or Scotland. If passed in its present form no man will be able to prescribe or administer medicine to a sick cow or horse without the collaboration of the qualified veterinary surgeon, and in this way the farmer and owner of stock will be much more adequately protected against fraud, and his animals against experimentation, than is the case in Great Britain at the present time.

It will not be a question as to whether a man is entitled to call himself a "Veterinary Surgeon," but whether he can even administer a dose of medicine, except under the direction of a properly qualified man. This should, on grounds of humanity and common sense,

appeal to every one, and should absolutely do away with anything like the condition of affairs which is exposed so clearly in the following paragraph from the *Isle of Man Times*:—

THE WHOLE-TIME GOVERNMENT VET.

Committee's Report.

The Committee which was appointed by Tynwald to consider the desirability of the Government appointing a whole-time veterinary inspector has just presented its report. The majority of the committee consider that such an appointment would be desirable, and might well be favourably considered at a future date; but the existing system appears to be adequate for the present circumstances, and having regard to the existing and impending position of the insular revenue, they cannot recommend Tynwald to take the step at present. The report is signed by Deemster Farrant, and Messrs. Robert Kneen, Kermode, and Crookall. Mr. Richard Cain dissents, and points out that the value of the Island's livestock can safely be put at half-a-million pounds, and to maintain this stock in healthy condition is a matter of first-class importance. "It is all very well," he continues, "to lull ourselves to sleep on the satisfactory state of cattle disease, but there are three inspectors to deal with all these cattle, and not one of them is qualified. This does not obtain in any other of our national services." On economic grounds and in the interests of public health he recommends the appointment of a whole-time inspector.

The point at issue, especially in the case of an island area such as that of the Isle of Man, concerns not only the control of contagious disease in the Island itself, but the inspection of the animals which may be exported; and, naturally, both purchaser and seller desire to know that stock exported to England or other places is healthy before the expense of transport has been incurred. It is because of disputes in this direction that the question of the necessity for the opinion of the properly qualified veterinary surgeon has arisen—but why have we as a profession allowed such an anomalous condition of affairs to exist so long?

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General Articles.

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THE USE OF THE CARBON-ARC LAMP IN THE TREATMENT OF GREASE.

By J. R. RIDER, M.R.C.V.S.

Darlington.

In the ironstone mines of Cleveland, where numbers of heavy horses are used for haulage purposes, grease is one of the conditions which frequently requires treatment. A discussion of the causes of grease lies outside the scope of this brief note. One would merely state a principle of treatment, which, of course, applies with equal force to any pathological condition, namely, the less advanced the diseased condition when treatment is begun, the better the prognosis which can be given. Countless methods of treatment have been adopted from time to time, most of them depending for their success on some astringent property of the dressing.

The method which has given most promising results in the writer's hands is the exposure of affected limbs to ultra-violet rays, generated by a carbon-arc lamp.

The mercury-vapour lamp has not been used, mainly because the other form was available.

Daily exposure has been found to be desirable to achieve satisfactory results. The underground stables in the mines are lighted by electricity, and since there is no risk of explosion, such as might be the case in some coal mines, there is no difficulty in using the carbon-arc lamp.

Thoroughness in the preliminary preparation of the limbs and in the subsequent exposure to the lamp are the essential features of the method. The hair surrounding the affected parts is clipped as close as possible, and the affected area carefully cleansed with a warm weak solution of sodium carbonate. By this means, when the process is efficiently carried out, it is possible to remove the secretion which is constantly present, and to bring about more favourable conditions for the action of the lamp. The limbs are left wet, and exposed to the lamp without undue delay. If necessary the animal's eyes may be protected by adjusting a suitable covering

to the head collar, and the operator's eyes are protected by suitable goggles.

It has been customary to hold the lamp at a distance of six to nine inches from the limb, and, while moving it in all directions, to allow an exposure of twenty to thirty minutes. Other limbs receive similar treatment, care being observed to ensure that each part of the affected area is exposed to the rays.

The following results have been observed to follow treatment as indicated :—

(1) A prompt reduction in the formation of the sebaceous secretion, accompanied by a lessening of the odour.

(2) A general reduction of the œdema of the limb, which usually accompanies the manifestation of the disease.

(3) Some reduction of the granulation tissue, though not its complete removal.

(4) A general improvement in the bodily condition of the patient.

These results have been found sufficient to justify the return to work of the animals, which, before treatment, were unsightly and objectionable on account of the odour and excessive sebum formation. Periodical exposure to the rays is usually sufficient to maintain the animal in a working condition.

If one is fortunate enough to find a case in its early stages, before the formation of granulation tissue, it is possible to arrest the advance of the disease.

Such a case occurred in February, 1930. This animal, after only one month's service underground, began to lose condition, and exhibited the early stages of grease in one hind limb. The lesion extended from the hock to the fetlock, over the region of the flexor tendons, and was characterised by staring hair, excessive sebaceous secretion, and some slight degree of œdema. The case was vigorously attacked by the method described, and after treatment of about two weeks' duration the limb returned to a normal state. The horse began to develop condition, and still remains free from grease.

It appears, therefore, that the carbon-arc lamp offers a method of controlling grease amongst ironstone mine horses. Every case in which it has been used has been improved, at least in some degree, while the favourable case, treated at an early stage, suggests that the results obtained may be still further improved by the prompt adoption of the method.

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COINCIDENCE OR CAUSE?

By Major R. F. STIRLING, D.V.S.M.
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THE few casual notes which follow are meant to encourage some colleague to answer a query which exercises my mind.

I have not at hand any literature to which I can refer with any great confidence, and I shall be deeply indebted for any information that your readers can afford me.

Many years ago in the South of England, I heard of a male dog which had to be destroyed on account of ferocity displayed only at certain times. The dog was a most peaceful, not to say sluggish, animal in its normal condition, but at times got so savage that it had to be kept under lock and key. The owners were a widow and her daughter. After some time the widow remarked that the dog's periods of violence always occurred when either she or her daughter were menstruating. Later on lady friends of theirs were attacked fiercely by the dog when they came to pay calls. Inquiry elicited the fact that invariably the callers had started their monthly troubles. Observation was kept over some months, and the same symptoms were always displayed at the same times as regards the owners. The dog was destroyed.

The second case came to my particular notice whilst playing in a mixed foursome of golf. I had with me my small fox terrier (male) on a lead. He struggled furiously when the fourth player, a lady, arrived at the first tee. Eventually he got away from the small boy who was in charge of him, and rushing towards the lady started to climb on to her leg and was beginning to masturbate when I caught hold of him, and sent him off the course still tugging hard at his lead and barking vociferously. Later I was informed that this lady was always annoyed in a similar manner by any dog when she was "unwell," as she had been on the day in question.

The third instance is rather vague. A lady I know keeps a number of dogs, and some of them have had the disease called hysteria. All recovered except one which, as she told me, got an attack every month at the same time "as regular as clock-work." These attacks became so bad that she reluctantly had the dog destroyed.

The last experience of this coincidence or cause occurred within the past month. I was touring in the Province and halted at a certain headquarters where I have numerous friends. One of these people had staying on a visit a lady with her little girl aged eight, both strangers to this particular place. In order to entertain the little girl the host decided to gave a children's party, and accompanied

by the mother and daughter, motored round to invite all the other kiddies to tea. In due course they arrived at a house where there were two children and a large male retriever. When they got out of the car the dog, who knew the host (as we shall call him) well, took no notice of him, but advanced growling towards the lady. She, a dog owner, tried to pet him, but he continued to sniff at her legs, growling under his breath at the same time. Her little girl was then making friends with the two children she had come to invite to her party, whilst the adults chatted. Suddenly a shriek was heard, it all happened within a minute of their meeting, and the host had to tear the dog off the prostrate body of the little stranger girl. The host came hurrying for me whilst the little girl was taken back to his house. I went to his assistance, as the civil surgeon was not at head-quarters. I first saw the dog, which was then securely chained, and found him showing signs of distress and evidence of emission of semen along the lower surface of his abdomen. Leaving him securely fastened, I hurried on to see the poor little girl. I found that the dog had torn off part of the top of her dress and scratched her on the shoulder, and also bitten her on her little breast. Lower down he had torn her frock and inflicted a bite about a quarter of an inch deep at its deepest part at the top and inside of her thigh, within an inch of the lip of her vulva. I had the wounds cauterised and dressed and the child sent off at once for anti-rabic treatment.

On making discreet inquiries I found that the mother's menses had started that morning, but that she had never before been troubled by dogs as she had been that day. It was impossible to get a full history of the dog, as he had been with this particular family only a few months. During these months he had never shown any signs of temper: on the contrary, he had been a great playmate of the children.

The dog was kept under strict observation for fourteen days, and showed no further signs of rabies, and is now apparently quite normal.

I have also been informed of an entire horse out here, belonging to a lady, which invariably became savage when it was approached by its owner during a certain time in each month. The animal became so dangerous and unmanageable on these occasions that it was sold.

This is all the evidence I can place before your readers, and I confess it is meagre. If the occasions are more than mere coincidences, the analysis is interesting. No. 1 was a dog which displayed symptoms towards any woman at a particular time; No. 2 was a woman to whom any dog was a danger; No. 3 is too vague to make any comment upon; whilst No. 4 is (so far as can be ascertained) an instance of a particular dog and a particular woman. I shall be grateful for any comments or help.

ON TREATMENT OF STERILITY IN COWS WITH WHEAT GERM OIL (VITAMIN E).

By P. VOGT-MOLLER, M.D., and F. BAY, D.V.M.

Denmark.

(PRELIMINARY COMMUNICATION.)

THE existence of a fat soluble anti-sterility vitamin—vitamin E —must now be considered established. The literature concerning this vitamin up to the year 1927 is to be found in Evans and Burr's (1927, 1) monograph; we would, however, mention here that the first communication about such a vitamin is due to Evans and Bishop (1922).

Vitamin E is found in certain vegetable oils, in largest quantities in wheat germ oil, but, as mentioned, also in many other oils of vegetable origin, *e.g.*, in crude maize oil (Sure, 1926), but not in the commercial product of maize oil; it is also to be found in plant leaves, *e.g.*, in lettuce leaves. Little or no vitamin E is found in animal substance: it is, for instance, not found in cod-liver oil.

As yet the importance of vitamin E to the organism has only been elucidated as far as rats are concerned, the above works only comprising experiments with these animals; Beard (1926) has, however, proved that mice, too, need vitamin E.

As far as we know the literature does not comprise any works on the need for vitamin E of other animals than those mentioned, nor do we know of any communications concerning the therapeutic usefulness of vitamin E preparations in domestic animals.

The sterility occurring when this vitamin is lacking in the food is of a different pathogenesis in the two sexes: in the male animal the vitamin seems to play a part in the spermatogenesis, histologic changes of the testis being found in avitaminosis E, especially a more or less marked degeneration of the spermatogonia or even complete disappearance of the latter. In the female animal, on food without vitamin E, ovulation and implantation take place in the normal manner, the reproductive system being unimpaired and the sterile condition being due to the fact that the implanted ova became resorbed at an early stage of the pregnancy. In male as well as in female animals vitamin E may be stored to a certain extent.

In 1927, Evans and Burr (1927 (2) (3)) showed that various fats, *e.g.*, lard, when mixed with vitamin E (wheat germ or wheat germ oil) were capable of depriving the latter of its value as a vitamin; this vitamin destroying property of the fat increased with the growing

rancidity of the latter, and Evans and Burr (1928) drew the attention to " the possibility of destroying vitamin E by the development of rancid substance in wheat germ oil itself " ; it is then of importance to use fresh preparations. We shall not go into further details, but as far as researches of recent years are concerned, we refer to the monographs of McCollum and Simmonds (1929), and Jackson (1929).

The preparation used as vitamin E source in the investigations referred to below was wheat germ oil ; by courtesy of Miss M. H. Roscoe (Lister Institute, London), the wheat germs used, a very pure preparation, were delivered by Messrs. I. and H. Robinson, Ltd., Deptford Bridge Mills, London, and the wheat germ oil was made from the said wheat germs by the following simple procedure :— 500 gm. of wheat germ, heated beforehand to 100° C. for two hours, were extracted in percolator for forty-eight hours with two litres of peroxide; free ether, the ethereal, yellowish extract, was mixed with the fluid squeezed out from the moist wheat germs, the whole of the extract was filtered, and then evaporated in a vacuum distillation apparatus to 10 per cent. of the weight of the wheat germs used, and the clear yellowish oil that was employed was then obtained. For the reasons mentioned above, a frequent renewal of the preparation must be considered necessary. According to Evans (1928-29) wheat germ oil does only contain minimal amounts of vitamin A.

The dose of wheat germ oil necessary for rats is only a few drops daily, and according to Evans and Burr (1927 (1)) vitamin E (wheat germ oil) is efficacious both on enteral and parenteral application. That wheat should contain toxic elements extractive in ether, as was maintained by Hart, Miller and McCollum (1916), and by Hart, McCollum, Steenbock and Humphrey (1917), has, as is known, been thoroughly refuted by Osborne and Mendel (1919), and by all researchers of recent years.

As we had worked for years with the question of vitamin E and reproduction in small experimental animals (rats and mice) without, however, reaping essentially new experience, but still with the result that Evans and Burr's investigations could be verified in every respect, it was natural to try whether the experience gained could be used in practice, the more so as we had thought for some length of time that according to all probability the cause of sterility in cows should as a rule not be sought in pathological changes of the ovaries or the uterus as such, but had a complicated causative relation possibly associated with the manner in which cows are kept and fed in this country. For through generations, these animals have gradually

been selected almost exclusively according to the demand—more milk and fatter milk ; and at the same time it has been an ever-increasing demand that these animals should consume and assimilate sundry, otherwise worthless, waste products from various industrial undertakings (coco, soya, cotton, rape, sugar, etc.). In order to render it still more difficult for the cows to perform this task, to turn the above products into fat milk, they are fettered with a chain round the neck, and have to remain at the same spot up to nine months of the year, being prevented from getting exercise and sufficient access to the direct influence of sun, light, and fresh air. No wonder then that under these conditions, so abnormal to the primary nature of the cow, a loss of equilibrium or complete absence of certain substances necessary to impregnation and propagation may occur, but it is difficult to state which substances are lacking; to the general practical observer, however, it seems as if there is a reason to direct the attention, especially to the absence of three substances : *viz.*, protein, minerals, and/or vitamins, and of the latter, one may perhaps be justified in thinking especially of vitamin E.

In the experiments referred to below we administered, in the rather rough dosage stated, the wheat germ oil intramuscularly to cows that had often been in heat, but could not become pregnant despite repeated leaps. Before each treatment we explored per rectum, and we did only inject the preparation in cases where the anatomical conditions were apparently normal, *i.e.*, where there were no palpable alterations of the uterus, the ovaries, and the oviducts, and, of course, where there were no marked pathological changes in the animal in general. The experimental animals, all of the red Danish milk race, were selected gradually, as in practice we found subjects that were considered well suited for the experiments, and were in the custody of owners or holders willing to allow the experiment, and to undertake not to dispose of the animals until we had had an opportunity to investigate into the result of the treatment, *i.e.*, two to three months after the leap.

The cows have been selected irrespective of age, some were treated the day on which they were in heat, others outside the period of heat, as far as possible the former were covered on the same day, whilst the latter were covered the first time they were in heat after the treatment. The animals are mentioned below in chronological order with information about dates of calving, and leaps, and about the dose of wheat germ oil employed ; we remark, however, that in case nothing else is stated, the delivery was normal, and the cow then became normally clean.

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EXPERIMENTAL ANIMALS.

(1) Owner, R. R., farmer of S. Five-year-old cow. Calved 1/4/30. In heat, and covered 10/5, then quiet for two months, again in heat, and covered, and then covered regularly every third week. When in heat the cow was treated 6/11 with 10 c.c. of wheat germ oil intramuscularly and covered on the same day, and was then quiet. On examination, 7/2/31, the cow was found to be pregnant (about three months).

(2) Owner, the manor of H. Ten-year-old cow, No. 117. Calved 20/1/30. Covered 27/2, 20/3, 10/4, 1/5, 23/5, 14/6, 22/7 (ovary treatment on the same day), 12/8 (ovary treatment repeated); was then covered every third week except a few times in the autumn, where the cow was not brought to the bull even if in heat. Treatment, 8/11 with 10 c.c. of wheat germ oil intramuscularly, covered 21/11, and was then quiet. On examination, 11/2/31, the cow was found to be pregnant (about two and a-half months).

(3) Owner, same as under (2). Five-year-old cow, No. 160. Calved 4/5/30. Was covered 5/6, 27/7, 16/8, etc., until treatment, 8/11, with 10 c.c. of wheat germ oil intramuscularly, then only covered once, 28/11. On examination 11/2/31, the cow proved to be pregnant (about two and a-half months).

(4) Owner, same as under (3). Three-year-old cow, No. 194. Calved, 5/1/30. Covered, 20/2, 3/4, 29/4, 22/5, 23/6 (ovary treatment 22/7), covered again 17/8, etc. When in heat 8/11, treated with 10 c.c. of wheat germ oil intramuscularly, but not brought to the bull until next heat, 1/12, then quiet. On examination, 11/2/31, the cow was found to be pregnant (scarcely two and a-half months).

(5) Owner, the manor of B. Three-year-old cow, No. 59. Calved, 13/6/30. Covered 13/7, 5/8, 9/9, 10/10, 1/11. Treatment 11/11, with 10 c.c. of wheat germ oil intramuscularly, was covered 18/11, and was then quiet. On examination, 6/2/31, the cow was found to be pregnant (about two and a-half months).

(6) Owner, same as under (5). Five-year-old cow, No. 110. Calved, 17/6/30. Covered, 7/8, 19/9, 20/10, 11/11. When in heat, 11/11, treatment with 10 c.c. of wheat germ oil intramuscularly, and covered on the same day. On examination, 6/2/31, the cow proved to be pregnant (about three months).

(7) Owner, same as under (6). Eleven-year-old cow, No. 213. Calved, 14/10/29. Covered, 28/12/29, 27/1/30, 16/2, 28/3, 17/4, 14/5, 27/6, 25/7, 15/8, 4/9, 26/9, 14/10, 11/11. Ovary treatment two to three times. When in heat, 11/11, treatment with 10 c.c. of wheat

germ oil intramuscularly and covered on the same day; became quiet, but proved not to be pregnant on examination 6/2.

(8) The farm of A. Five-year-old cow, No. 29. The cow slunk, 29/4/30. Covered 17/6, 6/7, 31/9, 2/10. Treatment, 12/11, with 20 c.c. of wheat germ oil intramuscularly, covered 14/11 and 26/11; was brought to the bull 17/12, but was restless and had to be forced, was then quiet. On examination, 24/2, the cow proved to be pregnant (two and a-half months).

(9) Owner, L. H., farmer of R. Three-year-old cow. Calved, 4/1/30, but a prolapse occurred; has been covered several times (exact information has not been obtained). Ovary treatment, 5/8, 16/8, and 1/9, but was in heat every week or every fortnight, then treated with iodine (by a colleague), but continued to be in heat; ovary treatment repeated 23/10. Treatment, 12/11, with 20 c.c. of wheat germ oil intramuscularly, covered on the same day, and three to four times later on. On examination, 22/1 and 17/2, the cow was found not to be pregnant. (Perhaps this cow ought to be excluded from the number of experiments, as, owing to the complication occurring during delivery, there is every reason to suppose that the sterility may have been of an anatomicopathological causation).

(10) Owner, the manor of R. Seven-year-old cow, No. 9. Calved 24/7/30. Covered 7/9, 2/10, 8/11. Treatment, 12/11, with 20 c.c. of wheat germ oil intramuscularly, covered twice, the last time 25/12. On examination, 24/2/31, the cow proved not to be pregnant.

(11) Owner, A. M., farmer of M. Six-year-old cow, No. 10. Calved 28/10/29. Covered 10/5/30, 25/7, 24/8, 30/10, 19/11. When in heat, 19/11, treatment with 20 c.c. of wheat germ oil intramuscularly, was covered on the same day and has been quiet since. On examination, 10/2/31, the cow proved to be pregnant (about two and a-half months).

(12) Owner, I. O., small holder of K. Six-year-old cow. Calved in July, 1929; milked satisfactorily. Covered for the first time two and a-half to three months after calving, and then every third week by two different bulls; a couple of months ago the owner gave up hoping to get the cow with calf. Treatment, 22/11/30, with 12 c.c. of wheat germ oil, as the cow had been in heat a few days before; was covered 14/12, and on examination on 24/2/31 the cow proved to be pregnant (about two and a-half months).

As will be seen, the above material is not so comprehensive that it is possible safely to base anything decisive on it, but, nevertheless, it will presumably hint that vitamin E preparations may be of therapeutic value in sterility in cows. When everything is considered,

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also the fact that the dosage was rather an arbitrary one, and that two of the "negative" cows proved incapable of being influenced despite repeated treatment of the uterus and the ovaries, whilst several of the positive cows resisted repeated ovary treatment, we believe to be justified in saying that in the case of such a batch of permanently sterile cows as we have had to do with here, none of the methods hitherto in common use would have yielded better results after one treatment. We therefore believe that the results encourage continued experiments on a considerably larger scale, and we have commenced such experiments, using partly wheat germ oil, partly a vitamin E concentrate.

RÉSUMÉ.

Referring to vitamin E and the importance of this vitamin in the organism, and to the pathological alterations occurring when vitamin E is lacking in the food, the results of treatment of sterility in cows with wheat germ oil (vitamin E) are communicated. The results obtained after a single dose of wheat germ oil administered intramuscularly must be termed so satisfactory that they encourage further experiments with the said therapy.

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CHRONIC DILATION OF THE STOMACH OF THE DOG.

By W. P. BLOUNT, M.R.C.V.S.
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IN a previous paper (1) the writer presented certain normal features concerning the stomach of the dog, and during his investigations on that subject he was attracted by the prevalence with which "gastric dilation" occurred. In order to appreciate better the

macroscopic features of this condition it is intended to recapitulate briefly the essential anatomical characters of the normal dog's stomach.

When removed fresh from the cadaver, the stomach of the dog is felt to possess definite "tone" (firmness) due to the thickness of its walls, and there is usually quite a distinct configurative line of demarcation between the *fundus* and the more thicker *pars pylorica*.

Internally (best examined by slitting the organ along its greater curvature) the fundus presents ridges and folds of mucous membrane; the latter (about ten in number) run parallel to the curvatures of the organ. They are not effaced under pressure usually, whereas the sinuous folds are definitely associated with distension of the organ. Two of the primary folds appear to pass into the pyloric portion of the stomach, where they effectually assist in forming the line of demarcation between the two stomach areas, namely, *fundus* and *pars pylorica*.

The thickened mucous membrane of the *pars pylorica* possesses but a few low ridges since its increased tonicity is due chiefly to hypertrophy of the muscle layers.

The *water-distention capacity* of the stomach of the average dog is about 1,080 c.c., or nearly two pints. The *physiological capacity* is believed to be about two-thirds the water-distention capacity, *i.e.*, about 720 c.c., or 26 ounces.

The greater curvature is seen to be, on the average, about 2.31 times as long as the lesser curvature for the normal empty stomach; for the fully distended organ it is about four times as great. It is convenient to discuss the changes in chronic gastric distention in the dog under two headings: (1) Anatomical; (2) Physiological.

(1) *Anatomical.*—On first handling the organ the most important character in which it differs from the normal stomach is its tone. The dilated stomach is thin, flabby, and devoid of turgidity. Internally there are equally important changes. The folds of mucous membrane are never as numerous as in the normal stomach, nor are they so well developed. On the contrary, the *ridges* are frequently greatly increased. This is to be expected because their presence is due to the relaxation of the walls of the distended organ which causes a wrinkling, often of almost honeycomb appearance. The stomach tone is lost, so that the mucous membrane becomes excessively ridged and disorganised. Further, during distention neither the *pars pylorica* nor the lesser curvature of the stomach vary very much, whereas the fundus swells and accommodates the ingoing contents.

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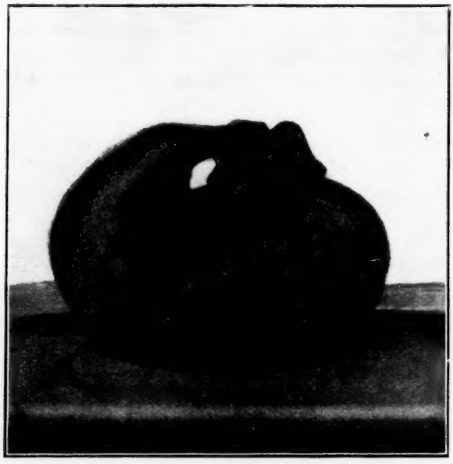
The first evidence of chronic gastric dilatation is the presence of additional ridges and a thinning of the upper part of the *fundus*. In time, with continuing irritation, this thin area spreads, so that in extreme cases practically the whole of the fundus becomes thin-walled. The general appearance is one of degeneration, pallor, atrophy, and loss of character (atony) in that there may be no mucous folds and few very sinuous low ridges.

The *pars pylorica* is affected very little, although it, too, loses tone, and is obviously thinner than normal. In some cases there may not be any pyloric sphincter, because the muscle layers are atrophied and unable to hold back the gastric contents.

The ratio between the lesser and greater curvatures is seen to increase by about 25 per cent. Normally this ratio is as 1 : 2.31, whereas here it varies from 1 : 2.50 to 1 : 3.33, with an average of 1 : 2.93 (*see* Table A). The higher the ratio the greater the degree of distention, but this does not necessarily bear any relationship to the degree of chronicity.



Photograph of Dog's Stomach enormously enlarged due to chronic Gastric Dilation (Artificial Distention due to water.)

Greatest Length	...	12 inches.
Greatest Breadth	...	8 inches.
Capacity	... ...	3,000 c.c.

(2) *Physiological.*—In the examination of a stomach from an animal which has suffered from chronic gastric distention, the diagnostic feature is its abnormal capacity coupled with degenerative changes in the mucous membrane.

In addition to allowing the organ to hold abnormal quantities of food, gastric distention causes alteration in the stomach structure, and consequently of its function. Gastric atony means inefficient churning of its contents and consequent failure of the gastric juices to penetrate the food mass. The degenerate mucous membrane means inefficient outpouring of secretion with consequent indigestion,

and more work for the pancreatic and intestinal glands to perform. Thirty dogs were examined, and of these fifteen were seen to be abnormally distended, which, as the animals were taken consecutively and indiscriminately, indicates the extreme prevalence of the condition.

Ætiology.

Brumley (2) considers that chronic gastric distention is uncommon in small animals, but Hutyra and Marek (3) discuss the question more fully. In the consideration of the causation of this condition, we are faced with the fact that the present-day house-dog cannot in many respects be considered normal. His food, exercise, and general behaviour under existing civilised conditions are certainly not natural, so that one must infer that the condition in question is created by man himself rather by any fault of the animal. The possible causes may be as follows :

(*a*) Pyloric stenosis ; (*b*) old age ; (*c*) absence of vitamin B, or other factor known to be associated with gastric movement, like vagal degeneration, etc. ; (*d*) repeated acute dilatation.

(*a*) *Pyloric Stenosis* is not common, although practitioners do occasionally meet with cases where the pylorus appears to be temporarily, sometimes fatally, closed. Physiologists teach us that its tonicity is maintained by the presence of acids in the first portion of the duodenum, and one action of the pancreatic juice is to neutralise these acids and so cause relaxation of the sphincter ; but these factors and the relationship between the abdominal sympathetic and vagal nerves is till incompletely understood.

Foreign bodies in the *pars pylorica* will also cause partial or complete stenosis of the pyloric valve, but again, that is a rare condition. Occasionally nature endeavours to overcome pyloric ulceration by hypertrophy of the muscle layers, which causes incomplete pyloric stenosis, as also does tumour formation.

(*b*) *Old Age.*—This is a physiological cause of gastric dilation ; but as chronic dilation of the stomach of the dog occurs at any age (from puppyhood to maturity) this need not be considered.

(*c*) *Vitamin B.*—Inasmuch as this vitamin is present in nearly all proprietary dog biscuits, and in addition is not destroyed by ordinary cooking methods, it can hardly be regarded as having an important bearing on the question. Little is known in canine pathology of sympathicotonic conditions, or of vagal inhibition (both of which may conceivably be associated with gastric distention), but in

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repeated acute dilation of the stomach we have the predominant cause of the chronic state.

(*d*) *Acute Gastric Dilation.*—The two cardinal factors associated in the production of this condition are: (*a*) excessive quantities of foodstuffs; and (*b*) abnormal foods.

For many years it has been the custom for dog fanciers to feed their animals but once in the day. The probable reasons for this are that it is economical, little trouble, and a prevalent belief that dogs should be fed once only in twenty-four hours. Unfortunately, these fanciers are frequently dog breeders, and pass on these ideas to their respective clients, so that the average layman believes it a mistake to feed his dog more than once daily. This is, of course, quite erroneous, because no dog in a natural environment will limit itself to one meal per day; nor will it do so in *unnatural* surroundings, provided the food is supplied oftener. The important fact which is overlooked is that the capacity of the dog's stomach is not adapted for large quantities of food. Not only does the fancier feed his dogs once daily, but because of economical reasons he is unable to purchase the foods natural for the dog (namely, carnivorous materials), because of their high prices. He therefore gives the animal large quantities of unnatural foods once daily, and this, in the writer's opinion, is the greatest cause of chronic gastric dilation. The bulky nature of the material fed causes a primary distention, which is aggravated by the disintegration of the carbohydrates. Putrefaction occurs, gases are formed, the stomach still further distends, and in many cases the distention becomes more or less permanent.

Another probable cause in the case of puppies is the overloading of the stomach with cow's milk or other unsuitable food. It has to be remembered that young animals sucking their mother's milk receive very small quantities at body heat, and usually of normal composition. It is, therefore, very easy to commence gastric disturbances by overloading the animal's stomach with abnormal foods at wrong temperatures. Cow's milk is very different from bitches' milk, more particularly if it is heated: the cream, lime, and content, taste, vitamins, and colloidal properties are all altered, but because the puppies do not show externally any signs other than perhaps a "pot-bellied" appearance, few people realise the possible harm which is thus commencing.

Treatment.

As the condition is seldom diagnosed during life, treatment is not resorted to on many occasions. A careful examination of many

patients will reveal signs compatible with chronic gastric dilation. The essentials in treatment are a drastic reduction in the quantities of foods supplied (preferably feeding several times daily), and above all, supplying natural foodstuffs. Tonics such as arsenic, gentian and nux vomica may be tried, also ferments like Taka-diastase (for starchy materials), and peptone, and HCl (for nitrogenous foods).

The work embodied in this paper was carried out whilst the writer was holding the Centenary Post-Graduate Fellowship, Royal (Dick) Veterinary College, Edinburgh.

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Summary.

(1) The macroscopic features of the stomach of fifteen dogs suffering from chronic gastric dilation are compared with those of a normal stomach. These include characters of the mucous membrane and

TABLE A.

The respective lengths of the lesser and greater curvatures of the empty stomachs of freshly killed dogs suffering from chronic gastric dilation, and their ratios:

Dog. No.	L.C. cms.	G.C. cms.	Ratio.
2	14	37	1 : 2.50
5	7.5	24.5	1 : 3.00
7	16	40	1 : 2.50
10	10.5	29	1 : 2.76
12	9.5	28.5	1 : 3.00
14	9	30	1 : 3.33
15	8.5	26	1 : 3.06
16	16	44	1 : 2.75
17	10.5	35	1 : 3.33
18	10	30	1 : 3.00
19	8	24	1 : 3.00
20	—	—	—
23	8.5	22	1 : 2.59
25	5	15	1 : 3.00
26	11	34	1 : 3.10
Average (14)	10.3	29.9	1 : 2.93
Average for Normals (7)	12.5	27.7	1 : 2.22

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of the stomach generally: water distention capacities, and curvature ratios.

(2) The ætiology of the condition is considered under four headings, namely: (*a*) Pyloric stenosis; (*b*) old age; (*c*) factors associated with gastric movement like vitamin B, vagus nerve, etc.; (*d*) repeated gastric dilation. The two commonest causes are believed to be: (1) overloading of the stomach; and (2) the use of abnormal foods.

(3) Short notes concerning treatment are added.

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(2) Brumley, O. V. (1922): "A Text-book of the Diseases of the Small Animals." Baillière, Tindall and Cox, London.
(3) Hutyra and Marek (1926): "Special Pathology and Therapeutics of the Diseases of the Domestic Animals." Vol. II. Third American Edition. Baillière, Tindall & Cox, London.

TABLE B.

Data concerning the stomachs removed from freshly killed dogs:

Dogs No.	Estimated Weight, lb.	History.	Condition of Stomach.	Water Distention Capacity.
2	40	Normal	Dilated	900 c.c.
5	18	Normal	Dilated	450 c.c.
7	30	Abnormal	Dilated	900 c.c.
10	25	Normal	Dilated	1,400 c.c.
12	30	Normal	Dilated	1,150 c.c.
14	30	Abnormal	Dilated	1,200 c.c.
15	25	Normal	Dilated	1,500 c.c.
16	60	Normal	Dilated	3,000 c.c.
17	35	Normal	Dilated	1,650 c.c.
18	20	Normal	Dilated	900 c.c.
19	15	Abnormal	Dilated	600 c.c.
20	38	Abnormal	Dilated	1,000 c.c.
23	10	Abnormal	Dilated	525 c.c.
25	11	Normal	Dilated	500 c.c.
26	35	Normal	Dilated	1,800 c.c.
Average				
(15)	28	Varied	Dilated	1,165 c.c.
(7)	28	Normal	Normal	1,080 c.c.
(8)	18	Abnormal	Abnormal	588 c.c.

THE ETIOLOGY OF "LOUPING-ILL."

A Review of the Literature.

By W. A. POOL.

Introduction.

"LOUPING-ILL" has been recognised as a scourge of the sheep stock on hill farms in certain areas of Scotland and the north of England for more than a century, and a good many investigators have carried out more or less extended inquiries with a view to ascertaining its nature. Almost from the beginning these investigators have recognised, either that "louping-ill" occurs in the form of widely differing types, or that other diseases are included under the same name, and at the outset it appears to be necessary to emphasise this point. While "louping-ill" has characters special to itself, it has many aspects which invite comparison with other diseases. In the first place it is essentially a nervous disease, and symptoms of brain or of spinal cord involvement, or both, are prominent features of all cases. Paralytic diseases in domesticated animals are of great economic importance throughout the world, and in many instances, unfortunately, they are still very imperfectly understood. In the absence of clear knowledge as to the pathology of the diseases of this type, there is perhaps justification for the use of the popular or layman's names which are in current use. Other examples of such conditions are "kumri" in horses and in camels in India, tick paralysis of animals and man as seen in Canada, South Africa and Australia, "renguera" of sheep in Peru, "swing-back" of lambs, and many other diseases.

PART I.

Review of the Literature.

Before proceeding further, it will be convenient to give a general idea of the work of previous authors.

DUNCAN (1807) dealt with "louping-ill" at two places in his treatise. In the first section, "louping-ill" was dealt with as a disease of lambs, and in the course of the six lines devoted to the subject, it is clear that the author was referring to the disease as we understand it, because he spoke of its paralytic nature.

Under the heading of "trembling," "thwarter" or "leaping-ill," he spoke about the disease in greater detail. He stated that the above names are synonymous, but recognised that they are

applied indiscriminately to many diseases. He spoke of the disease as we know it at the present time, but his account included a great deal of extraneous matter and references to symptoms which are obviously related to other conditions.

HOGG, THE ETTRICK SHEPHERD (1807) described the disease under the head of "thwarter ill," but this name is usually reserved for the disease of animals caused by the presence of *Coenurus cerebralis* cysts. Hogg's contribution is not very important, and is not as illuminating as his article on braxy in the same book.

TODD (1832) was evidently a farmer. He considered that overstocking was the main cause of the disease, and said in this connection: "young sheep which feed upon small spots of sweet ground" are apt to become infected. He stated that bad seasons lead to a heavy death-rate from "louping-ill."

LAING (1832), a shepherd, gave a good description of the symptoms, and said that the kind of land which is affected is dry and barren, and carries hard indigestible types of vegetation with little variety, and in consequence provides a poor supply of food in the early spring.

FAIR (1839) attempted to describe the disease, but from the great variety in his description of the symptoms and lesions, it is obvious that he included conditions which are not related to "louping-ill." He was a layman, but this inability to define the disease was even intensified by an editorial note at the foot of the article, which took the form of a letter to the *Veterinarian*. The note congratulated Mr. Fair on his ability to describe the disease, and indicated that his letter was inspired by Messrs. Young and MacLean, Veterinary Surgeons, of Jedburgh. The editorial note also referred to Hogg's account of the disease, and to an article by Tait, of Portsoy, at page 114, Volume 8, of the same Journal. Actually, the article referred to was at page 611, and undoubtedly referred to a disease which has no connection with "louping-ill." The deaths occurred on a farm in Forfarshire, and were probably the result of an acute digestive disturbance caused by the food available.

COWAN (1857) contributed an article which was edited by Gamgee, and merely repeated the views expressed generations previously by others.

GAMGEE (1857) in his text-book, "Our Domestic Animals in Health and Disease," included an article on "louping-ill." He mentioned investigations carried out by Professor Murray, of Cirencester, in

1862, and by Mathewson; but it has not been possible to trace the original publications of these writers. Gamgee discussed "trembling" as a separate entity from "louping-ill," but only devoted the following lines to it: "Trembling is a somewhat badly defined disease. The term is sometimes applied by shepherds to almost any internal inflammation, the onset of which is characterised by a severe shivering fit. It is sometimes applied to a form of louping-ill, when it is attended by marked muscular tremblings."

BORTHWICK (1863) gave some account of the disease, but like other authors of that period was not sufficiently critical in his diagnosis.

THE TEVIOTDALE FARMERS' CLUB (1879) considered the disease, and there is reference to their deliberations on the question in the Transactions of the Club. In the course of the previous twelve months a questionnaire had been sent out to the members, and Aitchison (1879) gave a résumé of the answers received. He discussed the conditions in which the disease arises in considerable detail, but these need not be referred to in the present paper. The points raised in the paper are, however, of very great interest, as they involve consideration of the management of hill farms.

THE TEVIOTDALE FARMERS' CLUB (1881) published the report of a mixed Committee of agriculturists and scientists in the Transactions of the Club. Among other causes the committee suspected ergotised grasses.

The Club asked the Highland and Agricultural Society to take up the question and, as a result, a Committee was appointed by the Society to deal with the matter.

FIRST REPORT BY THE SPECIAL COMMITTEE APPOINTED IN 1881 BY THE HIGHLAND AND AGRICULTURAL SOCIETY TO INVESTIGATE "LOUPING-ILL" (1882).—The Committee was composed of agriculturists and scientists, Professor Williams, of the New Veterinary College, Edinburgh, Professor Wilson and Dr. Aitken being among the members. The first report was published in 1882. The Committee had made inquiries concerning the incidence of the disease in space in Scotland, and had found that the bad areas were parts of the West Coast and of the Border Counties. A Mr. Brotherston, a botanist, reported to the Committee on the geological formation of the affected districts and on the flora. He found no difference between the geological formation of "diseased" and "clean" land, but was very struck by the large amount of withered herbage of preceding years which was present on the "louping-ill" pastures.

The plants concerned were chiefly *Nardus stricta** (mat grass or wire bent) and *Aira cæspitosa* (tufted hair grass or bull snouts), and he found that these grasses were invariably covered with fungi. *Cladosporium herbarum* was most commonly present, but he also noted *Ustilago urceolarum* and ergot. He did not consider that any of the plants found on the pasture were capable of causing the disease in their normal state, but was particularly struck by the presence of ergot, and suggested that the symptoms of ergot poisoning and of "louping-ill" are similar.

Williams gave an account of the disease, and this is included in the report of the Committee. He realised the diversity of the conditions included under the name "louping-ill" and considered that in the majority of cases the cause of illness was starvation. He recognised the "joint-ill" cases, and the cases due to "wool ball," and gave a fairly good description of what may be termed true "louping-ill."

A certain amount of bacteriological work was carried out, but those responsible for it were obviously dealing with contaminated cultures. The Committee suspected that ticks might transmit some micro-organism and be responsible in this way for the incidence of the disease.

Second Report by the Special Committee appointed in 1881 by the Highland and Agricultural Society to investigate "Louping-Ill" (1883).—The bulk of this report was devoted to the botanical surveys made by Brotherston, and to general considerations of the conditions of hill sheep farming and of their bearing upon "louping-ill." Great prominence was given to the possibility that access to withered and rough grasses might have a close connection with the incidence of the disease. The relationship of ticks was discussed to some extent, but in the light of existing knowledge this part of the report was not very important. None of the evidence advanced in support of any theory as to causation was really based upon accurate experimental evidence.

Williams (1883) gave the results of his investigations in the body of the report. He named the disease *Chorea paralyticapvis*, and considered that in the Western Highlands two outbreaks occur annually—in the spring and in autumn—while in the Border Counties only a spring outbreak occurs. He tested the theory that fungi on the grasses were responsible for the disease, and this is discussed elsewhere. He referred to the commonly-held belief that ticks

* The names given are those used in the Report.

are closely related to the incidence of the disease, and noted that the tick infestation was frequently very light, and that while there might be few or no ticks on affected sheep, healthy sheep from the same flock might be heavily infested.

He recognised that if "louping-ill" was present, ticks were present; if ticks were absent, there was no "louping-ill"; and that the appearance of ticks on sheep in April and early summer was coincident with the annual spring outbreak of the disease. He then gave a detailed description of what he spoke of as moulds in the tissues surrounding the spinal cord. He considered that ticks inoculated these moulds into sheep from contamination of their mouth parts, or alternatively, that they carried the moulds into the alimentary tract when swallowed by the sheep. The errors of this work are discussed elsewhere.

There is no doubt that the investigators working at this time were hampered by the existing state of knowledge regarding the life histories and habits of ticks.

THIRD REPORT BY THE SPECIAL COMMITTEE APPOINTED IN 1881 BY THE HIGHLAND AND AGRICULTURAL SOCIETY TO INVESTIGATE "LOUPING-ILL" (1884).—The following quotation gives a good idea of the outlook of the Committee: "As far as your Committee was able to ascertain, there was very little 'louping-ill' or 'trembling' during the past season. With a view to clearing up an important point raised by the report of last year, *viz.*, that eradicating rank and coarse vegetation also got rid of the disease, and to meet the objection raised by many, that some of the roughest hills were most exempt from the disease, Mr. Brotherston made a careful examination in July of Dalgleish, at the head of Ettrick, a very rough but healthy farm, and Craikhope and Howpasley, at the head of Borthwick, also rough but very liable to disease, and the following is his report:

"I found that though the pastures at Dalgleish were 'rough,' and also composed of the same species of plants as in the diseased places, they were in very different proportions. On Dalgleish the *Juncaceæ* (rushes) and *Cyperaceæ* (sedges) predominate, *e.g.*, *Luzula* (woodrush), *Juncus*, *Scirpus*, and *Eriophorum* (cottonsedge). There was *very little* land that was in any way likely to be liable to 'louping-ill,' and that only on parts of some of the steeper southern slopes.

"From Dalgleish I crossed over by Moodlaw Loch to Craikhope and Howpasley, where I found the pastures very different; the *Gramineæ* (grasses) greatly predominated on the parts liable to

'louping-ill.' So that, in point of fact, both districts may be said to be 'rough,' but the two are widely different, as the predominating plants on the one are not subject to be ergotised, while those on the other are so. Though this may not properly be called confirmatory evidence that roughness of the pasture is a cause of the disease, still, I consider it very good negative evidence to that effect."

SCOTT (1889), in his book on blackfaced sheep, described "louping-ill," but he appears to have relied entirely on the recent reports of the Committee of the Highland and Agricultural Society for his information.

WILLIAMS (1889), in his text-book on the "Principles and Practice of Veterinary Medicine," gave considerable attention to "louping-ill," but repeated all the errors referred to in his previous work.

KLEIN (1893) carried out an investigation in Northumberland for the Duke of Northumberland. He examined eleven sheep and six lambs, and most of them were killed for the purpose: some in the earlier and some in the later stages of the disease. Unfortunately, he was even less critical than some of the previous authors concerning the type of case which could be accepted as "louping-ill," and at least some of his cases were affected with other diseases. He found that the most important lesions consisted of engorgement of the vessels of the *pia mater*, particularly at the base of the brain and the anterior surface of the *medulla oblongata*; the congestion was, however, limited chiefly to the surface, the brain substance itself being practically normal; there was an excess of cerebro-spinal fluid. In the lungs, he found lobular congestion affecting a large portion of a lobe.

He found other lesions which had not been mentioned by any other authors, namely, hæmorrhagic spots on the endocardium of the ventricles and other parts of the heart, and gelatinous exudation in the pericardium. He said: "Of all the appearances that I have described, those affecting the brain and the medulla are the only ones which could account for the symptoms observed during life and for the fatal issue. The affection of the lungs, severe only in few cases, and the affection of the pericardium, only in few cases conspicuous and almost absent in lambs, would not produce any notable symptom during life, and could not be the cause of death so rapid in some cases. The actual changes of the lung and heart observed in lambs are in conspicuous disproportion to the severity of the illness and the fatal issue."

The cases in which the thoracic lesions were found were obviously not typical cases of "louping-ill."

He discussed the seasonal and local epizootic character of the disease, and considered that the causal agent was contained on or in the soil, and that there was evidence that the disease was spread from one animal to another. He dealt with the tick theory and discredited it.

The blood was sterile, but in six out of seventeen cases he was able to grow a bacillus from the cerebro-spinal fluid. Two lambs inoculated subcutaneously with a culture of the bacillus merely suffered from a local reaction. Two lambs inoculated subcutaneously with cerebro-spinal fluid which had been kept in sealed tubes for about a week, remained healthy.

Klein's work did not lead to any definite progress.

McFADYEAN (1894) contributed an important article on the disease, and this work appears to have been given curiously small prominence by subsequent authors. It was the best description of the disease hitherto published, and may be considered as the starting point of rational investigations into its nature.

He obtained fifteen cases for examination in the course of a tour of ten days in Northumberland, and carried out certain cultural and inoculation experiments with material from the lambs examined. He demonstrated the presence of a coccus which was presumably the cause of illness in two paralysed lambs in which there were abscesses involving the spinal column. He failed to produce the disease in healthy lambs by the inoculation of certain materials from cases of "louping-ill" in which there were no discoverable lesions, and from which he was unable to incriminate any pathogenic micro-organisms.

He discussed some of the earlier publications on the disease, and showed the errors of Williams' observations. He pointed out that Klein failed to recognise that the name "louping-ill" covers a variety of conditions, and that as Klein did not describe the symptoms exhibited by each of his cases, it was not possible to form an opinion as to their nature. The fact that Klein found thoracic lesions to be so important, indicated that at least some of the cases were due to illness from causes unconnected with "louping-ill." Klein apparently did not examine the spinal cord in all his cases, and may have missed a suppurative or other lesion in that situation. He pointed out that although Klein cultivated a variety of microbes from the fluids or tissues of the diseased sheep, he failed to prove that any of them were casually related to "louping-ill."

The following quotation from McFadyean's report gives a good statement of the position regarding " louping-ill " at that time :—

" Without attempting to decide which of them has the best claim to the name, I feel warranted in saying that the following are the principal morbid conditions at the present time grouped under the head of ' louping-ill ' :

" (1) Pyæmic spinal meningitis, caused by pyogenic bacteria.

" (2) Gastritis and enteritis from the indigestible substances (wool, sand, dried grass) in the stomach or intestines.

" (3) Disorders of brain functions, paralysis, and general weakness with, in some cases, excess of cerebro-spinal fluid in the cranial cavity, but without gross lesions in any of the organs of the body.

" The first two of these conditions cover most of the cases of ' louping-ill ' in lambs, and the third includes the bulk of the cases in adult sheep. The cause or causes of the last of these groups of cases have not yet been satisfactorily determined, but all the experiments hitherto made indicate that these cases are not bacterial or transmissible by inoculation."

Meek and Greig Smith (1896) evidently attempted to make quite a serious investigation into the disease. They made themselves acquainted with a good deal of the work carried out previously, and with the general circumstances in which " louping-ill " occurs in Northumberland, and with the opinions held by farmers. They gave their views on the conditions in which the disease occurs, and on its symptomatology and pathology, but there was nothing original in their account, and they were obviously handicapped by their ignorance of veterinary science. They gave great prominence to the view that the disease is transmitted by ticks, and came to the conclusion that the ticks transmit soil organisms in the course of taking blood from the host, and that these organisms are the cause of " louping-ill." They carried out a few simple inoculations with material they considered likely to carry the causal agent, but the results were all negative. They were handicapped by lack of knowledge concerning the habits and life-histories of ticks and by their ignorance of bacteriological technique. The work they did in connection with the bacteriology of the disease was worthless.

Greig Smith and Meek (1897) referred to their 1896 publication in such terms as to infer that they had produced some real evidence that " louping-ill " is caused by a soil organism transmitted to the sheep by the tick. The paper consists of a useless account of the

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various micro-organisms they were able to cultivate by means of defective and unjustifiable technical methods.

MEEK AND GREIG SMITH (1897) again wrote in such terms as to infer that they had already produced evidence incriminating the connection between "louping-ill" soil organisms and ticks. They discussed the possibility of anthrax being a very prevalent disease in sheep on Scottish hill farms, and even inferred that "louping-ill" is frequently mistaken for it. They attempted to obtain evidence as to the nature of the disease by exposing muzzled sheep and sheep covered with an oily dressing on "affected" pastures. The dressing was expected to repel ticks. This work is discussed elsewhere.

WILLIAMS (1897) had been asked by the Highland and Agricultural Society, in 1893, to carry out further investigations to determine whether his earlier work could be borne out or contradicted, as some writers had expressed great doubt concerning the accuracy of his conclusions. He merely repeated his earlier views.

As already pointed out, he was handicapped by lack of knowledge concerning the habits of ticks, and had described certain experiments which were wrongly conceived. These experiments are discussed elsewhere.

MEEK (1898) gave a paper on "louping-ill" at a meeting of the Teviotdale Farmers' Club. He emphasised the connection between the tick and "louping-ill," but apparently his opinion was only based on the fact that the tick and the disease are seen at the same season.

WHEELER (1899) supported the work carried out by Williams. He pointed out the unsatisfactory state of the existing knowledge regarding the classification of ticks, and gave a detailed account of his own observations. He considered that sheep in bad condition were more liable to be attacked by ticks in the spring, and stated that owing to the mild climate, ticks were numerous twice during the summer in Alnwick Deer Park as against once in other parts of Scotland and the North of England. Most of the article is invalidated owing to the author's acceptance of Williams' work with the various types of micro-organisms from contaminated cultures. The following quotation is of interest: "No explanation has ever been given, so far as I am aware, to elucidate the apparent paradox that while sheep taken from foul ground are known to produce "louping-ill" on clean hill land, yet the cultivated lowlands, to which thousands of hill sheep are drafted every autumn to be fed off, are never infested."

McFadyean (1900) wrote an article which was chiefly a criticism of the work which several authors had carried out since his first article was published. Like the article of 1894, it has not received adequate attention from subsequent authors, who would have avoided errors if they had realised its value.

What is "louping-ill"?—No very precise answer can be given. The symptoms and lesions are not sufficiently characteristic. Attempts to define the disease from a summary of the views of Border farmers and shepherds are disappointing. He said: "To sum up our knowledge with regard to the symptomatology and lesions of what is termed 'louping-ill,' it may be said that neither by the one nor the other is it possible to say with certainty whether a given animal is subject to the disease or not."

His own investigations had shown that laymen's views are often misleading, and that several diseases are included within the one name. He pointed out that while Williams was alive to this point, nevertheless, Williams did include other clinical entities in his own conception of the disease. McFadyean made the following remarks concerning the lesion surrounding the tissues of parts of the spinal cord which Williams had claimed to be due to invasion by moulds: "Originally this extra-dural jelly-like substance was regarded by him as a bacterial product—a sort of zoogloea—but there is room for more than a suspicion that what he described was in reality the normally present adipose tissue of the spinal canal in a state of œdema. At any rate, the description quoted above would stand as fairly correct for cases examined by myself, but the 'slimy tenacious substance' lying outside the dura mater was quite obviously fat which had undergone the so-called serous atrophy."

Referring to Klein's work, he said: "My own experiments, like those of Dr. Klein, failed to elucidate the pathology of the cases included in this group, but they indicated that these cases are not bacterial, or at least not transmissible by inoculation with the blood, cerebro-spinal fluid, pericardial fluid, or spinal cord of diseased animals."

Report of the Departmental Committee appointed by the Board of Agriculture to inquire into the Ætiology, Pathology and Morbid Anatomy and other matters connected with the Diseases of Sheep known as "Louping-Ill" and "Braxy" (1906).

This Committee was appointed in 1900, with Professor Hamilton, of Aberdeen University, as President.

It made very detailed inquiries into the disease, and circularised landed proprietors, sheep owners, and others in different parts of

the United Kingdom extensively, in order to ascertain the distribution of "louping-ill," and found that in Scotland it occurred chiefly on the West Coast and in parts of the Borders. It considered that the disease occurred fairly extensively in parts of Northumberland, Cumberland, and Westmorland, and also in small areas in widely scattered places as far south as Somerset and Sussex, and as far east as Suffolk. They were unable to discover evidence of its existence outside of the British Isles.

Certain of the committee's remarks in connection with unsuccessful attempts to transmit the disease are quoted in Part II of this paper.

After examining thirteen cases which were slaughtered for the purpose, the Committee said: "The most remarkable feature in connection with all these cases, the animals having been slaughtered at the height of the disease, was that the post-mortem examination proved negative, and did not throw any light on the causation of the malady. The blood, the cerebro-spinal liquid, and the brain and spinal cord were not altered in appearance. Inoculations, moreover, of the blood, the cerebro-spinal liquid, the brain and spinal cord, failed to communicate the disease or, indeed, as subsequently recorded, to cause an elevation of temperature.

"The kernel of information obtained by a study of the cases was contained in the fact that, when the clear peritoneal liquid was incubated in sealed tubes it became turbid from the development within it of a large sporing bacillus, the bacillus which we identified afterwards as the cause of the disease."

The Committee did not agree with Williams' account of a lesion in the tissues surrounding the spinal cord, or with Klein's account of lesions in relation to the pericardium.

Animals susceptible.—Sheep, cattle, pigs, and geese were said to be susceptible to "louping-ill."

The effect of transferring "clean" sheep to affected pastures.—"It is notorious that if sheep taken from the land where 'louping-ill' does not prevail, be turned out on that which is infested, the liability to their acquiring the disease is very great; and, again, it has been supposed that the tick is the intermediary through which the disease is transmitted."

The Committee carried out certain experiments designed to yield evidence concerning the manner in which the disease occurs naturally in sheep. These experiments are dealt with elsewhere.

Most of the report concerns work carried out with an anaerobic bacillus which the Committee considered to be the cause of the

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disease. Progress in bacteriology since that time indicates that this organism was an agonal or post-mortem invader, and quite unrelated to the causation of "louping-ill."

BISHOP (1911) collected engorged ticks from an area of country infected with the disease, and also examined blood smears from affected sheep. In the course of examining blood squeezed from engorged ticks, he found a flagellate which he described.

HOARE (1913) referred to Bishop's note when describing the life history of *Trypanosoma melophagi*, and considered the flagellate Bishop described to be a trypanosome of that species surviving in the tick's blood.

MCGOWAN AND RETTIE (1914) described the pathology and morbid histology as indicated by a study of eleven cases. They said: "In the acute stage of the disease we have found the pia mater and the grey and white matter of the brain infiltrated with small round cells. The vessels of the brain and the cord are engorged with blood, and their perivascular sheaths are infiltrated with small round cells, cells with a clearer round nucleus and a larger amount of protoplasm, and cells with deeply indented nuclei which in some cases almost resemble polymorphonuclear nuclei. In the chronic stage, the pia mater, nerve roots, the grey and white matter, and the perivascular sheaths of the vessels are infiltrated with the small round cells and with cells probably derived from proliferation of connective tissue cells. The nerve cells, especially of the anterior horns of the spinal cord, are in all stages of disintegration, from the conditions of chromatolysis, pyknosis, eccentricity of nuclei, to entire disappearance and replacement by neuronophages. We have made cultures on blood agar from the cerebro-spinal fluid of a number of acute and chronic cases alike, but have never succeeded in getting any growth.

"In two of our most acute typical cases we injected pieces of the brain emulsified in the cerebro-spinal fluid, intracerebrally, after trephining, into two other sheep without result.

"The cerebro-spinal fluid in all the cases was water clear, and on microscopical examination showed very few cellular elements."

MCGOWAN (1915) published a monograph on "louping-ill." One-third of the book is devoted to what is called a review of the literature. No mention, however, is made of the articles by McFadyean of 1894 and 1900, or of Meek and Greig Smith, 1897; Greig Smith and Meek, 1897; or of Klein, 1893.

Connection with ticks.—The author apparently wrote on the assumption that the tick theory was disproved. He said:

". . . quite unmistakable cases of true 'louping-ill' may occur on farms where there are no ticks, yet the shepherd states that he has no 'louping-ill' in his flock, and justifies his opinion by stating that there are no ticks to cause it." Again, in discussing this subject, he said in connection with Hamilton's investigations: "With regard to the relation of the tick to the production of the disease, elaborate experiments were undertaken to test the possibility. The conclusion is that the evidence is against it. The simple and conclusive natural experiment of finding 'louping-ill' cases on land where ticks have never been known to exist on the sheep, such as on low ground arable farms, was not, however, considered by the Committee."

The author went into the question of symptomatology in elaborate detail which it is not necessary to discuss here, as it was uncontrolled by experiments proving the presence or absence of an infective agent, or by an accurate method of diagnosis.

Bacteriology.—"The view enunciated here is that true louping-ill in its different varieties is caused by *Bacillus bipolaris septicus ovium.*"

The author's summary is worth quoting: "Louping-ill or Trembling, according to the view propounded here, is divisible into two groups: true louping-ill and pseudo louping-ill. True louping-ill (which includes 'staggers' of hill farms and arable farms) is divisible into several varieties, as mentioned in the text. Specially, according to the view expressed here, does it include 'braxy' or 'sickness,' and 'grass sickness,' which are held to be very acute forms of the disease. The disease 'milk sickness' in lambs is considered also to be a variety of this same disease for reasons given in the body of this article.

"These diseases are considered to be essentially of the same nature, in that they are held to be caused by the same organism—the *Bacillus bipolaris septicus ovium.*

"Epidemiologically they are considered to be different, in that while braxy is usually produced by eating rapidly large quantities of succulent material covered with hoar-frost, true 'louping-ill' in most of its varieties is considered to be caused chiefly by exposure to extreme degrees of temperature within a short interval. 'Milk sickness' is considered to be in a restricted degree caused by contagion. The grass tick is held to be responsible for the production of the bulk of the cases of pseudo 'louping-ill.' Navel-ill, with its attendant joint-ill, contributed some cases, while aggravated woolball, injuries, etc., add a few to the sum total included in this term.

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A discussion on possible means of prevention and treatment is embodied in the text."

It is almost unnecessary to point out that McGowan's views as to the ætiology of " louping-ill " are quite erroneous and unsupported by evidence.

STOCKMAN (1916) gave the first account of an extensive investigation he carried out. In the first place he discussed the nature of the cases which are to be admitted as true " louping-ill," and limited himself to those which are left after suppuration in the neighbourhood of the spinal cord, and " wool ball " have been eliminated.

He defined his cases as follows :—

(*a*) " The sheep or lambs came from farms notoriously affected with ' louping-ill.'

(*b*) " They had been suddenly attacked by a non-febrile or feebly febrile disease characterised by symptoms of stupor or nervous excitability, followed quickly by paralysis of the fore or hind extremities, or both.

(*c*) " The disease had appeared in what is recognised as the ' louping-ill ' season.

(*d*) " On post-mortem examination no macroscopic lesions of any recognised disease which could account for the symptoms were present.

(*e*) " In the internal organs (bowels excepted) of animals slaughtered at the point of death, or in those examined immediately after death, no micro-organisms were discoverable by microscopic examination, and none were cultivated from them by the ordinary methods of the laboratory."

He pointed out that while this classification may exclude some cases of true " louping-ill," it leaves plenty of material for examination, and excludes many conditions with which it has no relationship.

The tick theory.—He said : " The suggestion that ticks play some part in producing the disease is a very old one. Some investigators have given the suggestion very scant consideration, being intent on establishing another cause of their own creation ; some authors, again, claim on quite inadequate grounds to have established beyond dispute that ' louping-ill ' is a tick-borne disease.

" The circumstantial evidence which led to the suggestion is strong, and it was therefore entitled to the most careful consideration and investigation. It has been observed : (1) That ticks always

infest the pastures where 'louping-ill' is present. It has been asserted, however, that the disease sometimes occurs on land where there are no ticks, and had this been established the tick theory might be rejected; but the evidence in support of the assertion is not strong, and it is further vitiated by the absence of reliable information concerning the diagnosis. It is certainly beyond dispute that the disease may be unknown on land which is infected by ticks, but this does not invalidate the tick theory, as it may only mean that the ticks on such pastures are not infective, or, in other words, have never had the opportunity of becoming carriers of the infective agent of the disease by meeting with diseased sheep. (2) That 'louping-ill' is a seasonal disease occurring chiefly in April, May and early June, and to a less extent in the autumn. (3) That ticks are prevalent in these seasons. It has even been asserted, however, by some of those who claim to have investigated the disease seriously, that ticks are absent in the summer months. It is a fact that ticks, especially the fully engorged, and therefore more noticeable, females, are more prevalent at the time mentioned, but the assertion that ticks are absent at other times must be due to faulty observation and defective knowledge of the life cycle and habits of the ticks, as will be shown later.

"The fact is there is no time of the year in which at least some ticks may not be found on sheep running on tick-infested pastures, and a study of the life cycle and habits of the tick fully accounts for this fact."

He had considered the possibility that "louping-ill" might be the same condition as the so-called "tick paralysis" seen in some parts of the world, and said in this connection: "No tick in Great Britain has been found capable of producing 'tick paralysis.' Hundreds of *Ixodes ricinus* and *Hæmaphysalis punctata* can feed in all their stages on sheep without injury. Pulling ticks off 'louping-ill' sheep is not followed by recovery, as is frequently the case in 'tick paralysis' of other countries."

Search for a tissue parasite.—He said: "This question received particular attention in the pathological studies made by the writer and the veterinary staff at the Board's laboratory. Several hundreds of blood smears have been examined from affected sheep in all stages of 'louping-ill,' day by day, from highly susceptible sheep placed on infected pastures, and also from the original stock on the pastures. Other materials, such as the pericardial, peritoneal, pleural and cerebro-spinal fluids, urine and milk, from animals dead from 'louping-ill,' or killed when showing symptoms, have been

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examined with and without the aid of the centrifuge. Smears from, and sections of, all the organs, including the various parts of the brain and spinal cord, bone-marrow, lymph, and other glands, have also been examined. They have been examined in every conceivable way: unstained, by dark ground illumination when applicable, and after staining by Giemsa's stain and its modifications, by Mann's method, and by the silver method of Levaditi. In no case has the examination established the presence of anything which could be regarded as a protozoan parasite, nor did the cells of the nerve centres show inclusion bodies.

"So far as pathological investigations go, and they have been carried very far in this respect, no investigator has yet succeeded in transmitting 'louping-ill' by the inoculation of body fluids or tissues of affected sheep. Claims have certainly been made to have done so by some investigators, but such claims do not stand even elementary investigation. All have admittedly failed to convey the disease by inoculating material taken from an absolutely fresh carcase of an affected animal at the moment of death.

"Notwithstanding these failures, some investigators claim to have conveyed the disease by material or cultures taken from carcases at a more or less advanced stage of putrefaction. Such material and such cultures from any animal could under the circumstances cause illness, and even death, when inoculated to another. No disease resembling 'louping-ill,' however, has been set up in that way, and it amounts to a reversal of bacteriological knowledge to say that the specific material of infection of a disease can only be obtained from the tissues after the latter have undergone some amount of putrefaction, and not from the fresh tissues."

The habits of ticks found on British sheep.—Stockman stated that he had only found ticks of the species *Ixodes ricinus* on "louping-ill" pastures. He discussed the question of the habits of ticks in considerable detail, and while a good deal of the data given was obtained from study of *Hæmaphysalis pinctate*, he infers that it applies to *I. ricinus*. This part of the work will not, however, be discussed in the present paper.

Experiments carried out to test the tick theory.—He said: "The tick theory has been submitted to experimental examination of a kind by previous investigators. Their examination, however, was confined to putting muzzled sheep on the pastures in order to exclude infection by swallowing a virus, and to inoculation with emulsions of ticks. Their writings make it clear that they had not considered seriously the life cycle of protozoan parasites, and the

possibility of an important relationship existing between these factors and the infection of sheep with 'louping-ill.' In this important respect the problem has been left almost entirely alone. Indeed, it is evident from the papers published on the tick question by Williams and by Meek and Greig Smith that they were under the impression that the ticks fed only once, and that if they spread disease it was by mechanical inoculation of a bacterium. Hamilton likewise believed in mechanical inoculation, though he did not think that ticks often carried the disease."

Experimental Work.—A good many experiments of various kinds were discussed, and these are summarised elsewhere in the present paper. Stockman's conclusions at this stage of his investigation were that the experimental evidence so far obtained was against the view that "louping-ill" was carried by ticks. He pointed out, however, that he had yet to test by direct experiment whether ticks acquiring infection as larvæ could remain non-infective in the nymphal stage, and become infective when adults. He considered that this was quite possible.

Leaflet on Braxy and "Louping-Ill" (1917), issued by the Board of Agriculture for Scotland. The following is an extract: "Investigations have on several occasions been made into the nature of these diseases, and theories have from time to time been advanced as to their cause or causes. Until further inquiry clears up the subject it would be unwise to give an opinion as to which, if any, view at present held is correct.

"The Board therefore do not express any opinion regarding the nature of treatment of braxy or 'louping-ill,' as based on the results of these investigations, but they desire to impress upon all flock-masters that certain general measures may be taken with advantage."

The pamphlet then advocated general measures which really relate to ordinary good husbandry. There is a warning that overstocking should be avoided, that regular and wide moor burning should be carried out, that draining and liming should be given attention, that ill-thriving stock should be drawn out from the pastures in the spring, that the sheep should be handled quietly, that dipping should be carried out in January on "louping-ill" farms, and that all dead animals should be immediately buried.

Stockman (1918) said, in the introduction to the paper, that in the experiments detailed in his previous article (1916), the only symptom which could definitely be taken as typical of "louping-ill"

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was paralysis, and that in the absence of paralysis or severe general symptoms, the results were adjudged to be negative. Temperatures were not taken, however, so temperature reactions may have occurred.

He said: "Since in the pathological experiments about to be described, certain symptoms were produced which immediately raised the question whether they could be definitely accepted as those of 'louping-ill' or not, it will be useful at this stage to state shortly what symptoms are generally regarded as being those of the disease by men of experience, although—and this is not surprising in the absence of an ascertained causal agent—opinion is by no means unanimous with regard to some of them.

"(1) It is said, and it agrees with the writer's views, that practically every sheep which is reared on, or is brought on to, 'louping-ill' pastures, passes through an attack of the disease in some form, and if it survives becomes highly resistant to further attacks, at least in a dangerous form. Were it not so, it is difficult to see how, in the long run, sheep could survive on such pastures. Many sheep, however, never show symptoms visible to the ordinary observer, but there are shepherds and flock-masters of great experience who can pick out as affected, sheep that appear normal to the ordinary man, and although no serious symptoms may develop later in these animals, they seem to acquire resistance for the rest of their lives. It would seem, then, that there is good reason to believe that 'louping-ill' may assume the form of a more or less slight indisposition.

"(2) The indisposition may be somewhat greater than in (1), and the animal may lie down continuously apart from its companions, only rising at intervals to move a short distance and then lie down again, or it may only move when chased.

"(3) The animal may be found down in a senseless and completely comatosed condition, with the head drawn round towards the shoulder, having lost all power to maintain itself on its legs, although the legs may be capable of performing paddling movements when the patient is laid on its side.

"(4) The patient may be found down but quite sensible, the anterior or posterior or both extremities being paralysed.

"Along with these basic nervous symptoms, others, such as general trembling, twitching of the muscles of the jaw, and frothing at the mouth, may be seen.

"It is obvious that classifications such as (1) and (2), which have nothing characteristic about them, open the way to the inclusion of cases which may not be 'louping-ill,' and it is certain that ailments

from other causes are actually classed as 'louping-ill.' If they are not excluded, so far as the collection of material for experimental investigation is concerned, there is bound to be great risk of obtaining results which can have no particular meaning. It must also be apparent to the pathologist that symptoms such as those mentioned in (3) and (4) could arise owing to the position of certain lesions caused by ascertained agents—pus microbes, for example."

He emphasised the importance of utilising tissues which were obtained in circumstances in which there could be no suspicion of agonal or post-mortem invasion.

Lessons of "Louping-Ill."—He said: "It is to be noted, having regard to the basis upon which material was selected, that the writer has only dealt, so far as natural cases are concerned, with those which showed the more severe and conclusive symptoms in life. That, however, does not detract from the value of the macroscopic observations, since he feels able to state, after examining a great amount of material, that the only macroscopic lesions directly connected with the severest cases of 'louping-ill' are œdema, and very occasionally congestion or groups of lymph glands, and, less frequently, superficial hæmorrhage in some part of the brain or the anterior part of the spinal cord. If it were possible to select for post-mortem examination with any certainty the mild cases believed to occur in the field, the probability is that little or nothing would be found macroscopically except œdema of certain glands."

He described and figured certain bodies found in the cytoplasm and nucleus of large and small mononuclear leucocytes, and considered that they were probably causally related to the disease. This question will not be fully discussed in the present article. There seems to be strong reason to doubt if these bodies were in any way related to "louping-ill," and it appears to be probable that they are "Kurloff bodies." He found that the blood was normal as regards the number of red cells, and he found no inclusions in the red cells which could be suspected to be parasites.

He found distinct microscopic lesions in the brain and spinal cord of cases which showed typical and conclusive symptoms, but said that even in these cases the lesions exhibited considerable variation both as regards their intensity and the area particularly affected. The lesions varied from congestion of the small vessels, with or without small hæmorrhages into the surrounding tissues, to more or less intense inflammation marked by passage of the white corpuscles into the sheaths of the vessels and into the nerve tissues.

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These inflammatory phenomena were more prominent in the grey matter, but were not confined to it.

The large motor cells sometimes showed cloudiness and vacuolation. At other times they showed a necrotic appearance with failure of the nucleus to take up stain. In chronic cases there was distention and fullness of the vessels and considerable thickening of the adventitia, and some of the large nerve cells were distorted and shrunken. Lesions were most evident in the lumbar region and in the cervical enlargement of the spinal cord. In the brain there was often nothing beyond more or less congestion of the small vessels with or without small hæmorrhages, although the inflammatory changes in the cord were acute. The meninges were usually normal and in most cases the cerebro-spinal fluid was practically devoid of inflammatory cells.

Even in chronic cases with permanent paralysis of particular muscles, no wholesale degeneration of tracts of nerve fibres was revealed by treatment by Marchi's method, but it seemed evident that a considerable number of individual fibres had undergone degeneration.

The remainder of the article was given over to a description of the author's numerous experiments, which are discussed elsewhere.

The following extracts from the conclusions are of importance :—

(1) " In investigating a disease like ' louping-ill,' the symptoms of which in naturally contracted cases may vary from those of indisposition to those of serious illness with fatal paralysis or coma, the milder form being much the more common, the experimental results must vary in the same way. It is therefore only by taking these results as a whole, and by being able to concatenate them with each other and with what occurs under natural conditions, that conclusions can be arrived at.

(2) " The juice of certain œdematous lymph glands and the blood from sheep affected with ' louping-ill ' when inoculated into other sheep, can cause a disease which may be fatal or may amount only to an indisposition. This disease is characterised by high temperature, in some cases by coma, nervous tremblings or twitchings, or even paralysis, by an absence of macroscopic lesions capable of explaining the symptoms, and by the presence of microscopic lesions in the brain and cord of varying degree, but referable to a pathological condition describable as myeloencephalitis, and similar to what are found in cases of naturally contracted ' louping-ill.'

(3) " Notwithstanding the first apparently negative results obtained with ticks (*I. ricinus*) in various stages which had in a

previous stage fed on sheep affected with 'louping-ill' in the field (previous article), it follows from the later results obtained in Part II that larvæ from females which as adults engorged on affected sheep, can give rise, as in (2), to a highly febrile and sometimes fatal disease in other sheep when put to feed upon them in very large numbers, and that adults fed as nymphs on affected sheep may have the same effect. It is possible that the apparently negative results recorded in the first article arose owing to the circumstance that only a small proportion of ticks become carriers of infection, but it is also probable that neglecting to take temperatures explains some of the apparently negative results.

(4) "The blood and juice of œdematous lymph glands from cases arising from experimental inoculation as stated in (2) and from infestation by ticks as stated in (3) can cause similar symptoms and lesions when inoculated to other sheep in series. Ticks allowed to engorge on these experimental cases during the reaction can, after moulding to their next stage, cause the disease in other sheep upon which they are put to feed.

(5) "It follows from (3) that the infective agent, whatever it is, can be transmitted from the female ticks through the eggs to the next generation of larvæ; but, although the positive results so far have been obtained with larvæ and adults, it does not follow conclusively from the results available that the ticks in their nymphal stage cannot also transmit the disease.

(6) "Since the disease can be transmitted to sheep in series by inoculation, it follows that the infecting agent is not a toxin, but a living agent capable of reproducing itself to some extent in the tissues of the animal into which it is inoculated. It also follows almost certainly from the fact of ticks transmitting the infection that the infective agent is a protozoan parasite. Some of the mononuclear leucocytes in œdematous glands and in the blood stream when treated by Giemsa's stain show in their protoplasm chromatin bodies which have some of the characteristics of protozoan parasites, including their staining reaction. It is not claimed, however, that a final statement can be made that these chromatin bodies are parasites, and the causal agent of 'louping-ill' Awaiting the results of further research on this special question, it is allowable to summarise the evidence in favour of the parasite view being correct: (i) The disease is tick-borne; (ii) inoculation with the fluids and organs of sheep containing the bodies reproduces the disease; (iii) the bodies stain after the manner of such parasites; (iv) the causal agent is apparently not ultra-microscopic, and the bodies are the only abnormal objects

observable under the microscope in materials which convey the disease by inoculation ; (v) the virulent material, if perfectly fresh, is sterile as regards bacteria (the infective agent appears to be retained by bacterial filters, which is evidence that it is not ultra-microscopic).

(7) " The blood of a sheep which has recovered from the disease produced by inoculation does not continue to be infective by inoculation to others as in the case of piroplasmosis (redwater), and it is therefore unlikely that ticks can infect themselves from such animals. The same is true of material taken from a chronic case of ' louping-ill ' contracted by natural infection.

(8) " A sheep which has passed through a reaction following upon inoculation is protected to a very considerable extent against the effects of a subsequent inoculation, just as a sheep recovered from ' louping-ill ' in the field is highly resistant to further attacks. A small number of sheep which had been inoculated at the laboratory with blood, survived exposure in the following season on ' louping-ill ' infected pasture, while four out of twelve (33.3 per cent.) other sheep not so inoculated, and exposed on the same pasture, died of typical ' louping-ill.'

(9) " The blood of healthy sheep when inoculated in large amount to other sheep does not cause a reaction.

(10) " The disease which has been produced experimentally by larval ticks (*I. ricinus*) from females off sheep affected with ' louping-ill,' and by adults which had fed as nymphs on infected sheep, and by the inoculation of gland juice and blood from such sheep, is in fact ' louping-ill.' To conclude otherwise would involve the following further conclusions, which are very difficult of acceptance :

(*a*) " That the experimentally produced cases with conclusive symptoms and lesions described in Part I, such as Lamb 11a, Lamb 13, and others, must be disregarded.

(*b*) " That there is a disease of sheep other than ' louping-ill ' characterised by similar microscopic lesions and by similar varying symptoms, which is tick-borne and inoculable, and that sheep suffering from acute and typical ' louping-ill ' in the field are invariably attacked at the same time by this other disease, since inoculation of their gland juice or blood constantly produces it."

Cure, Prevention and Eradication.—Atoxyl, arsacetin, novarsenobillon and trypanblue were tried as curative agents. These drugs all failed to have any curative effect on natural cases of the

disease. The cases selected, however, were all severe before the treatment was started.

Stockman considered that there was ground for hope that inoculation of the blood of affected animals would produce a valuable immunity without undue risk.

Eradication.—Methods of ridding pastures of ticks were discussed.

STOCKMAN (1919) published a brief note dealing with the duration of the infectivity of the ticks, and wrote on the assumption that his previous work had proved that ticks transmit the disease.

GAIGER (1920), in a popular article written for farmers, said that while there was a strong case for the tick theory, he had doubts about it. He did not consider that the " chromatin bodies " described by Stockman were parasites at all, and stated that they could be found in any anæmic sheep, and that in thirty-five healthy lambs examined in the previous year, he had found these bodies in each one of them, and also in sheep dying from braxy. He quoted Lignières in support of his view as to the non-parasitic nature of these bodies.

He discussed tick eradication, and considered that it is an impossible task.

GAIGER (1920) gave a general description of the disease in popular language for laymen. He discussed general theories regarding the disease, especially the relation of the tick, and the possibility of producing immunity by inoculation with the blood of affected animals.

WOOLDRIDGE (1923) wrote a very brief article which was obviously written from Stockman's publications.

STOCKMAN (1925) proceeded on the assumption that in his previous publications he had proved that the disease is infective and that it is transmitted by ticks.

He said : " On reference to one of the previously published papers (Vol. XXXI, p. 137) it will be seen that the author found that if the blood or juice of certain glands of affected animals was inoculated to healthy sheep a temperature reaction invariably followed, accompanied by other symptoms of varying gravity, and that a second inoculation with the same material, after an interval, although it might cause a reaction in some cases, but not all, was usually much less serious in its effects than the first.

" A small number of animals so inoculated was afterwards exposed on infected pastures, and no fatalities from ' louping-ill ' occurred amongst them."

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He regarded the work published in the article now under reference as a re-opening of his investigation, and said that one important reason for this course was that in the previous experiments apparently few of the animals used were lambs in the first few weeks of life, whereas such lambs provide by far the greater number of serious and fatal cases on infected farms during what is known as the " louping-ill " season.

He then described certain experiments involving inoculations with the blood of affected lambs, and concluded that while inoculated animals do not with certainty acquire absolute immunity to a second attack as the result of the inoculation, the second attack is likely to be much less severe than the first.

He then gave details of experiments in which inoculated lambs were exposed on infected pastures, and of experiments designed to ascertain whether the virus is thrown down by centrifugal force; also experiments designed to show the virulence of serum and of blood corpuscles, the viability of stored virus and the duration of virulence of the blood of recovered animals; and he also described several observations on tick infection.

All the experiments are dealt with elsewhere in this paper.

(*To be continued.*)

Clinical Articles

Three Types of Acari Isolated from Pigs affected with Sarcoptic Mange.

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RECENTLY I was asked to investigate an outbreak of dermatitis in swine. I was informed that the pigs, numbering about 100, became infected a few days after they were brought into the pens, all of which were under one roof. Animals which were not housed in this building did not appear to suffer; the affected pigs showed a definite falling off in weight and had suffered in their general condition. Some had been killed, and skin lesions had been noticed which detracted from the appearance of the carcases. Errors in feeding were at first

thought to be responsible for the condition by the owner, but this idea was given up after several feeding experiments had been carried out with no beneficial result.

Clinical Appearance.

At least two types of lesion presented themselves: in one there was a matting of the hairs on the back with a mass of exudate consisting of blood, serum, and skin scales; in the other, which was chiefly confined to the under surface of the body, there was a definite erythema studded with blood points and raised areas of skin, the typical picture of sarcoptic mange.

Method of Diagnosis.

By means of a mounted safety-razor blade, skin scrapings were taken from several pigs at different sites on the body. The exudate and skin scales were scarified and collected in separate envelopes, and in each case the skin was scraped until blood began to appear. A number of separate samples were taken from several pigs.

Method of Examination.

The skin scrapings were dissolved in 10 per cent. caustic potash solution and heated to various degrees up to boiling point. One or two acari were found and there was evidence of the disintegration of several others. Better results appeared to be obtained where a more dilute solution of caustic potash (3 or 5 per cent.) was used, and the material gently heated without boiling. Several acari were found by this method, and were mounted in Farrant's solution. Other scrapings were treated with clove oil and examined; this method was not as effective as the use of dilute caustic potash solution. The material was centrifuged, and coverslip preparations of the deposit were examined under the microscope with the low power objectives.

Result of the Examinations.

In the scrapings taken from the backs of the animals only one type of mite was seen, the acari found in this situation belonged to the Tyroglyphidæ. Dr. Evans, Lecturer in Entomology at Liverpool University, kindly examined some scrapings taken from the lesions on the backs of the pigs, and confirmed my finding that the only mite present was one of the genus Tyroglyphus.

In the scrapings taken from the under surface of the skin I found the mite which causes sarcoptic mange in pigs—*Sarcoptes scabiei* var. *suis*.

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In a scraping containing material from several parts of the body, I found a mite which I had difficulty in classifying, but which I considered to be a member of the group of forage acari. Mr. Pillers kindly undertook to try and trace this down, and he informed me that he considered it to be a member of the Tarsonemidæ, and probably *Pediculoides ventricosus*. Most authors consider these mites belong to a distinct family, and to be most closely allied to the Tyroglyphidæ.

It is well known that many "so-called" non-pathogenic acari are found upon animals, and it would be unreasonable to think that the pig was any exception. I have not seen any records of cases having been reported where other acari were present in addition to *Sarcoptes scabiei* in sarcoptic mange of pigs. In reporting these cases, I thought it might be of service to veterinarians when taking skin scrapings from swine to know that these parasites may be present, and the main cause of the trouble may be missed unless the under surfaces of the body are carefully examined for mange mites.

The interesting points in connection with this outbreak are: (1) the finding of two other types of acari in addition to *Sarcoptes scabiei* var. *suis*; and (2) the fact that considerable areas of skin presenting masses of blood exudate and skin detritus contained only acari belonging to the group of so-called non-pathogenic acari.

Poisoning by Bryony.

By R. HUDSON, F.R.C.V.S.
Retford.

SEVERAL fat lambs, towards the end of July, had died or been slaughtered when ailing, and eventually one was sent in for post-mortem examination. The animal was fat, and had evidently been purging badly.

On post-mortem examination I found lesions of acute gastro-enteritis, but nothing likely to have caused it: worms were not detected, nor could I recognise anything of a harmful nature in the rumen. The owner had reported that the lambs became ill suddenly, being drowsy, off feed, and badly purged. Some he had slaughtered, but this one had died before that could be done.

Visiting the farm, I learned that they had not been treated in any way, and that there were no poisonous substances, such as dips, corn dressings, etc., that they could have got at, so I went to the field where they had been for some time.

The hedges were overgrown, and in many places bryony, *Tamus communis*, was growing luxuriantly. It was plain to see that it had been eaten freely, and that the lambs had rested their fore feet on the hedge and wire netting to enable them to reach the more tender parts of the plant. It was difficult to find a branch of the main stem within their reach, they had stripped them off so clean.

Black bryony has always been recognised as a poisonous plant, and is described as a climbing herb, with alternate shining cordate leaves, small racemose unisexual flowers and scarlet berries. It flowers and produces berries during the summer.

White (*bryonia dioica*) is also a poisonous plant similar to the above, but does not flower and berry until September. Also, it is a dicotyledon with net-veined and divided leaf.

Both have large roots. Pieces of the black bryony used to be used as a rowel and inserted in a skin incision as a preventive of black-quarter.

Fracture of the Mandible in a Dog.

By R. MACHIN, M.R.C.V.S.

Royal Veterinary College, London.

SUBJECT : A three-year-old spaniel dog.

History.—Three hours previous to being admitted the animal had been run over by a motor car, and had bled profusely from the mouth. Upon examination it was at once seen that the mandible had been badly injured, the right horizontal ramus being completely fractured between the canine and molar teeth. The fracture was also impacted in such a manner that the posterior portion was resting on the anterior portion.

The animal was immediately given a grain of morphine, and half an hour later, under general chloroform anæsthesia, an attempt was made to repair the damage The fractured parts were brought into apposition without difficulty, and it was decided to wire them together. For this purpose, under strict aseptic conditions, two holes were drilled through the bones, one on either end. Silver wire was then passed from the outside inwards and back again, being finally secured on the outside. It was so tightened that the jaws were completely immobilised, and the dog was discharged next day.

The patient was kept on soft foods for a fortnight, during which time frequent inspections were made to see that the

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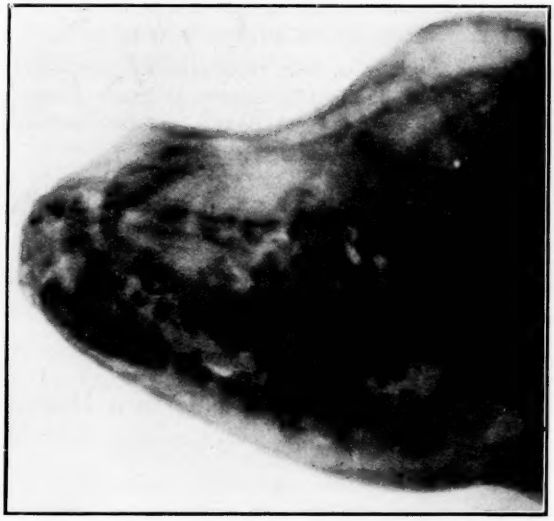
wire had not moved. After the first fortnight normal food was allowed, and the wire was extracted at the fifth week, a perfect union having been effected.



My thanks are due to Mr. H. J. Ede, M.S.R., the official Radiographer to the College, for the photograph reproduced here.

The figure shows the wire *in situ*, and I have another which shows the perfect alignment of the jaws after the wire had been removed.

A Hermaphrodite Cat.

By J. STEWART WOOD, M.R.C.V.S.
Parkstone.

A WHITE Persian cat, six years old, and the reputed father of kittens, on examination was found to be a true hermaphrodite. I was consulted on account of a prolapse from the vulva of what appeared to be a uterine tumour; on removal this proved to be an extra large testicle firmly attached to the vaginal wall by its epididymis. This testicle is shown in the photo, above the sixpence. The second testicle, the smaller, was situated above the vaginal roof, behind the upper labia; the operation scar is seen in the photo

about seven o'clock. The dark stain in the centre of the vulva is a little blood that exuded when the cat was secured.

The penis is of normal size, shape, and position, and shows slightly protruding, the cat urinates through it. I also found what looks like a female urinary meatus, but was unable to get a passage of urine there The vagina and vulva are extra large. There are only two teats. The animal is good tempered, and appeared in no way upset by the castration.

Translations

New Treatment of Fluke. By Prof. G. MAROTEL, *of the Lyons Veterinary School.—Revue Vétérinaire*, December, 1930.

OIL of male fern is known to be a classic remedy against distomes, but recently criticism has been levelled at its high price (10 to 20 francs per sheep, and 70 to 150 francs per cow), at its sometimes insufficent action, and above all to its danger (for it has caused fatal accidents). These defects have led to research for a better therapeutic remedy and for two years some ten new anti-fluke remedies have been issued without any scientific study of control ever having been published on the subject.

I considered it necessary to undertake experimental researches with a view to ascertaining what amongst these new treatments appeared to be most advantageous and to be recommended from the different points of view of *effectiveness, harmlessness, cost price, and ease of administration*. My studies are not yet finished, but in view

of the past rainy year a prevalence of fluke may be expected, and I consider that it is as well to make known that there is a remedy better than male fern, and that is *Vitan*.

Vitan is a Bulgarian product, which is sold in red gelatinous capsules as big as a cherry, and containing a liquid of the following composition: benzol, 78; vaseline, 5; camphorated alcohol, 5; essence of turpentine, 12. Price of a capsule, 2 francs.

I have experimented with this drug on thirty-five sheep with constant success and no accidents; the eggs of flukes disappeared from the excrement in three to four days; the animals treated did not seem in any way upset, although badly affected. Here is, therefore, an anti-fluke remedy which, being quite as effective as male fern, is clearly superior in several respects:—

(1) *Cost price is small.*—Two francs per sheep (for one capsule suffices), ten to fifteen francs per cow. Up to now no research has been conducted on this animal, but knowing its susceptibility to certain anti-fluke agents, it is not recommended to give more than three capsules.

(2) *Easier administration* by reason of its presentation in capsules; no need of the stomach sound, or risk of a false route. On the other hand, the treatment only needs a single intervention (in places of three or four for male fern), which decreases considerably the work of the attendant where, say, a flock of 300 sheep has to be treated.

The discovery of an easily marketable anti-fluke remedy is not only a progress for treatment of the malady, but should have its effect and repercussence on prophylaxis.

In practice fluke epidemics have for origin and point of departure the scattering of marshy grass land, pools, ditches, and stagnant ponds with excrement charged with eggs which emit individual parasites each day. The first thing to do then is to suppress these sowers of germs, and this can be done by systematic administration, preventive in some measure, of an anti-fluke agent to all the animals (ailing or not) of a flock one knows to be affected; one thus rids them of their parasites in such a way that at this time they cannot any longer throw out infective dejections. But to be effective this anti-fluke remedy should be *administered three times*.

(1) *Before putting out to pasture* (about April) to expel the flukes of individuals affected, and thus avoid contamination of the ground.

(2) *Five months later* (about September) for that is about the necessary time for adult worms to become egg layers. In effect it

has to be recognised that a few sheep escape the first treatment; their helminths therefore lay eggs which after two or three months form cercaria, which in their turn, after two or three months, are transformed after ingestion into adult distomes; total five months. If one expels them before this delay, one is then sure that they will not yet have been able to produce eggs, and this is the reason for the September worming

Finally, *the third intervention two to three months later* (towards November) after the return from pasture, to destroy the trematodes, the issue of some cercaria which may have been swallowed after the second treatment.

Thus, nothing but this rule of *a three period anti-fluke treatment before, during, and after pasturage* will rid surely and periodically all the animals of their distomes almost immediately after the arrival of these in the liver, before in all cases they have had time to become adult egg-layers. Vitan suppresses the voiding of eggs, therefore no more flukes are possible.

With male fern this therapeutic preventive was not realisable, as stated before, notably due to its too high and prohibitive price. But with a remedy as active, as handy, and as marketable as Vitan, I am sure that breeders and rearers—far from jibbing at the expense—will, on the contrary, ask for it. The benefits that they will derive will far outweigh the monetary cost. Monsieur Marotel concludes by hoping that all sheep breeders will unite for defensive measures against fluke, and that the regional veterinary surgeons of departments will support measures against fluke, and he assures them that if Vitan is used as he directs, the flukes of their region will be suppressed, and that the terror of sheep-breeders in France and her colonies will be definitely cleared away.

The Tasks of Veterinary Medicine in the Study and Prophylaxis of the Maladies of Poultry.—By DOBBERTTEIN. *Berliner Thierarzt Woch.*, June 2, 1929, pp. 421–426.

SINCE the Great War the study of poultry diseases has become a live subject, and aviculture is no longer considered by the agriculturist a negligible matter. The value of poultry products in Germany has risen within the last nine years to 483 million marks. This value is five times greater than that of the vine culture, and surpasses in importance the sugar industry, at 351 million marks, and the sea and fresh-water fishing industry at 95 million marks. The annual pro-

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duction of eggs increases from year to year in Germany; it went up to 485 million marks for 1927, whilst the total value of all poultry products (eggs, meat and feathers) was 944 million marks. And yet we imported, in 1927, eggs to the value of 276 million marks. To counteract this, the Reichstag, on November 28th, 1928, passed a resolution inviting the Government to stimulate the poultry industry and to organise the production of eggs on American lines. Before the War, Russia paid its external debts by the export of eggs. The value of eggs exported by Canada surpasses that of wheat. Denmark exported eggs in 1924 to a value of 150 million kronen.

Improvement of breeds, indispensable to the production of eggs, has brought about a less resistance to disease. Rustic breeds are more resistant to disease than selected breeds, but have insufficient output of eggs. Selection has notably brought about a pathological predisposition of the egg-producing organs: affections of the ovaries and oviduct formerly hardly known, now play a preponderating part in poultry farms. From 1924 to 1928, 2,033 fowls were post-mortemed at the Berlin Veterinary Schools. The percentages of affections of the oviduct for this quinquennial period were as follows: 1924, 2.9 per cent.; 1927, 4.7 per cent.; 1926, 11.5 per cent.; 1927, 14.3 per cent.; 1928, 14.8 per cent.

Nine per cent. of birds dying in and about Berlin were affected with inflammation of the oviduct or associated ailments. In Denmark, Brieg estimated a figure of 11.5 per cent.; Sweden, 10.5 per cent. (Lankholm); Holland, 21.2 per cent., all due to affections of the oviduct. At Pentaluma, in California, the greatest poultry-raising centre, maladies of the oviduct caused 42 per cent. of all cases of death. Inflammation of the oviduct preponderates.

Statistics also show the importance of contagious maladies in the mortality of birds. In Berlin, five contagious diseases: fowl cholera, fowl typhoid, fowl diphtheria, tuberculosis and leucæmia were discovered in 42.5 per cent. of autopsies. Acute infectious maladies like cholera and typhoid contaminate the ground, whilst chronic contagious maladies—leucæmia, tuberculosis, and diphtheria—become more and more frequent.

During the last five years, cholera was found in 17.5 per cent. of autopsies in Berlin, whilst the percentage was only 4.6 in Holland. This affection is hardly recognised in Denmark, and Carpenter has not yet observed it at Pentaluma. Official statistics in Prussia show that the contaminated premises fell from 2,080 in 1918, to 108 in 1924. Leucæmia is the most important of chronic contagious affections, because we cannot arrest it by drugs or vaccines, and do

not notice it in time. In Germany, Sweden and Denmark it averages 8 to 13 per cent. occurrences, but in Holland it is only 4.5 per cent. Selected races suffer more than ordinary breeds. Tuberculosis among fowls is rife in most of the above-named countries, California coming out best with an average of 2.6 per cent., thanks to good sanitary measures. Avian diphtheria and contagious epithelioma are prevalent in Holland, where vaccinations are practised on a large scale.

Zooparasitic maladies are important in certain regions, notably amidostomiasis of geese and echinostomiasis of pigeons. The pathogeny and treatment of these affections are still insufficiently known.

The subject of the affections of young birds becomes more and more important. Chick ailments may be disastrous to those practising artificial incubation. White diarrhœa and coccidiosis are two maladies which exact heavy tribute. Birds from artificial hatches eventually become less resistant than those from natural hatches. The eggs of wild birds placed in the incubator gave a higher percentage of hatches than those of selected breeds, a fact which shows that many of the eggs from selected fowls remain sterile as a result of maladies of the embryo.

Troubles of metabolism play a more and more important rôle in the poultry yard. The substitutes and additions, as numerous as varied, used on the farms cause digestive troubles, enterites, and intoxications ; 5.3 per cent. of fowls autopsied in Berlin died of non-specific enterites, a figure raised to 7 per cent. in Denmark and Sweden, and 10.5 per cent. in Holland. Maladies of the digestive tract caused 23 per cent. of affections in Dutch birds. If the albumen of the food is too abundant, fowls contract renal trouble and visceral gout. This arose in 2.5 per cent. of Berlin fowls, and 5 per cent. of Copenhagen birds. Avitaminosis seems to be very important, but its mechanism is still insufficiently known. Besides these four groups of ailments, maladies of the oviduct, contagious maladies, chick diseases, maladies of metabolism—poisonings—still play a great part in avian pathology : 8.3 per cent., Berlin ; 6.9 per cent., Leipzig ; 7.9 per cent., Sweden ; and 9 per cent., Denmark.

For the study of poultry diseases and to institute specific or drug treatment, laboratories and practitioners ought to work in concert : the laboratories making known the results of their researches, the practitioners informing the laboratories about the importance and practical value of the advice given.

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Abstracts of Current Literature

Bohl.—Amyloidosis of the Nasal Mucosa of the Horse.—*D.T.W.*—May 24th, 1930, pp. 321–322.

THE surgical clinic of the Veterinary Institute of Kasan received a black mare, five years old on August 15th, 1928, showing an ulcerated tumour on the left nasal mucosa. The horse came from a stable in which several cases of glanders had been found. The ophthalmo and Wassermann reactions had given negative results, and as a conclusion glanders was definitely excluded. The tumour, situated on the anterior third of the left nasal mucosa, had reached the size of a hen's egg, and it was decided to remove it. The surface was uneven, leathery, with many multiple nodular elevations of the size of a pin-head to a pea. The mass was of solid consistence and greyish-red tint. The lymphatic glands of the region, and the sub-parotid glands, were slightly swollen and sensitive to palpation. Regional anæsthesia was obtained by an injection of twenty centigrams of cocaine in eight grams of physiological serum into the maxillary nerve track. Twenty minutes after this injection the left nostril was incised for a length of seven centimetres ; a circular incision was made round the tumour, which was detached from the underlying cartilage ; the debris was removed with the curette. The healthy nasal mucosa, stripped in all directions, was solidly sutured, also the wound of the nostril. Painting with 5 per cent. tincture of iodine was carried out until perfect cicatrisation occurred.

The affected mucosa, greatly thickened, was infiltrated with amyloid deposits and tracks, from the periphery to the nasal cartilage, notably along the arteries, veins and capillary vessels. The sub-epithelial layer, the vessels and glands showed strong cellular infiltration. In the small arteries thickening and sclerosis of the tunica intima was such that certain vessels were completely obliterated. The glands were atrophied, the nasal mucosa not ulcerated, but covered with an infiltrated epithelial layer of histiocytes and fibroblasts, notably around the vessels and excretory ducts of the glands. The lumen of the small blocked vessels, besides red globules, showed a number of abnormal leucocytes and lymphocytes. Islets of amyloid infiltration occurred in the membrana nictitans. Amyloid infiltration was pronounced in the sub-mucous layer.

The case is interesting because amyloidosis is very rare, and because the pathological state brought about on the nasal mucosa resembles glanders.

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Cases of similar amyloidosis have been reported by Grovitz, Rabe, Joest and Frohner. The size of the lesions varies from that of a pea up to massive growths obstructing the nostrils, often with deep ulcerations.

Gaugh, M. A.—Protection of Wounds Against Flies.—*Revue Vétérinaire*, November, 1930, pp. 638 and 639.

NUMEROUS substances have been used on wounds, which one cannot protect by a dressing from the attacks of flies. All have been discarded on account of their caustic nature or repugnant smell.

This summer I have had a large number of horses galled by the pack saddle, and after dissecting out the dead tissue, I have regularly used an ointment to which I have added nitro-benzene and essence of mirbane, in the proportion of one in forty. Immediately after the application no fly attempts to approach the wound; the animals do not seek to rub the wound, which is no longer soiled, and heals rapidly. The formula is as follows, and I can thoroughly recommend it: Essence of mirbane, 1.50 gramme; formic aldehyde, 6 drops; true oil of cade, 5 grammes; Vaseline, Lanoline, *āā* 30 grammes. Incorporate very carefully.

Pouisset, M. G.—Distemper of the American Marten.—*Recueil de Méd. Vét.* Tome CVI. August, 1930.

THE author was called to treat an outbreak of distemper among twenty martens. After two or three days' illness, in the course of which the animals showed intestinal or pulmonary symptoms, the owner found a dead one in the pen.

Three post-mortems were subsequently made, and the lesions showed variations from simple congestion to massive broncho-pneumonia and acute enteritis. We cultivated on different media the soft marrow of a long bone, and the blood of the heart, both of which were sterile. It is to be observed that a couple of martens are worth 175 dollars the male, and 125 the female. It was important therefore to find a rapidly effective prophylaxis.

Sero-vaccination, according to Lederlé (N.Y.), did not arrest fatalities. It is besides difficult to imagine how one can give the time, patience, and adopt ruses to give subcutaneous injections to martens. We then advised the owner to give two centigrams of stovarsol on five days in a month. It is easy to make these animals take small compressed cachets in a piece of meat. Four months later we learned

that fatalities ceased from the administration of stovarsol, and that the lot was in excellent condition. It is known that stovarsol is used as a chemical agent in the prevention of distemper, and for this reason we suggested its use here.

News

Fowl Pox Vaccine
(Avian Diphtheria, Diphtheritic Roup, Cancer).

THE Ministry of Agriculture wishes to notify poultry farmers that it is now issuing a Fowl Pox Vaccine, at a charge of one penny per dose, to cover the cost of production. There will be a minimum charge of two shillings and sixpence, this sum covering the supply of thirty doses of the vaccine, and an instrument and brush for its application.

The vaccine has been extensively tested in the field during the past fifteen months, and during that period some hundreds of thousands of fowls have been inoculated, with very satisfactory results. The vaccine confers a solid immunity of at least four months' duration; it is free from danger, causes no constitutional disturbance, and does not interfere with egg production.

In order to keep down the cost of production and avoid unnecessary clerical work, cash must be enclosed with each order, which should be addressed to the Director, Ministry of Agriculture and Fisheries, Veterinary Laboratory, New Haw, Weybridge, Surrey. Cheques, money and postal orders should be made payable to "The Ministry of Agriculture and Fisheries," and crossed "Bank of England."

Personal

FEW men can boast a longer connection with the veterinary profession than Mr. James E. Bell, M.R.C.V.S., of Carlisle, who, on his seventieth birthday a few days ago, announced his decision to retire from active practice. His name, as well as that of his father, the late Mr. J. J. Bell (whose partner, Mr. Carlisle, was the inventor of the Carlisle inhaler for the administration of chloroform to the horse) is one of the best known amongst the veterinary surgeons in Cumberland and the Border district, and the original practice dates back to 1837. His sporting proclivities have been recognised by his appointment as Deputy Master of the Cumberland Farmers' Foxhounds, and also to the Carlisle Race Course Committee. Popular with his brother practitioners, they, and his fellow townsmen, will wish him good health to enjoy his well-earned retirement.